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A Novel Screw-cutting Device.

In *The Engineering Review* of July 6th we find an illustrated description of a new device for chasing screw threads of varying pitches without the necessity for changing gears, and have reproduced the engravings, with some additions of our own to make the matter plainer.

On the spindle of the lathe is a worm *B*, which engages with a worm wheel *C*, which, by means of the shafts and gears shown in Fig. 1, drives a spur pinion *H* at the back of the head-stock. This pinion engages with a rack *I I*, Fig. 2, which is attached to a sliding bar *K K*, so that these gears being connected, this bar will move back and forth across the head by the reversed motion of the lathe, as in cutting threads.

At the rear end of the bar *K* is pivoted the slotted lever *L*, its swinging end traveling over a graduated arc *Q*, to which it can be clamped at any point.

Moving freely in the slot of *L* is a stud at *M*, which is fitted with a roll, and is connected by a rod *N* to the lathe carriage; the endwise movement of this rod and the carriage with a given movement of the sliding bar *K* depending upon the angle at which *L* is set with the bar *K*. Thus, referring to Fig. 2, with the bar *L* in the position shown by the full lines, a movement of *K* equal to the distance *a b* would give a movement of the rod *N* and carriage equal to *c b*, while with *L* in the position shown by the dotted lines, the same movement of *K* (*a' b'*) would give a movement of *N* and the carriage equal to *c' b'*, and the resulting thread would be proportionately finer in pitch. Left-hand screws can be cut by placing the rack *I* below the pinion, screw holes being provided for that purpose. The arc *Q* can, of course, be graduated to the pitches cut in the various positions, and one edge of this arc can be made to show threads per inch, while the other gives threads per centimeter *precisely*.

Of course it is apparent that this is adapted only for comparatively short screws of moderately fine pitch, and that the details of construction are capable of improvement; but the principle is ingenious, and might be employed in many situations to advantage.

The device is the invention of Mr. J. S. Foley, 20 Richmond Gardens, London. We are not informed as to whether it is patented in this country or not.

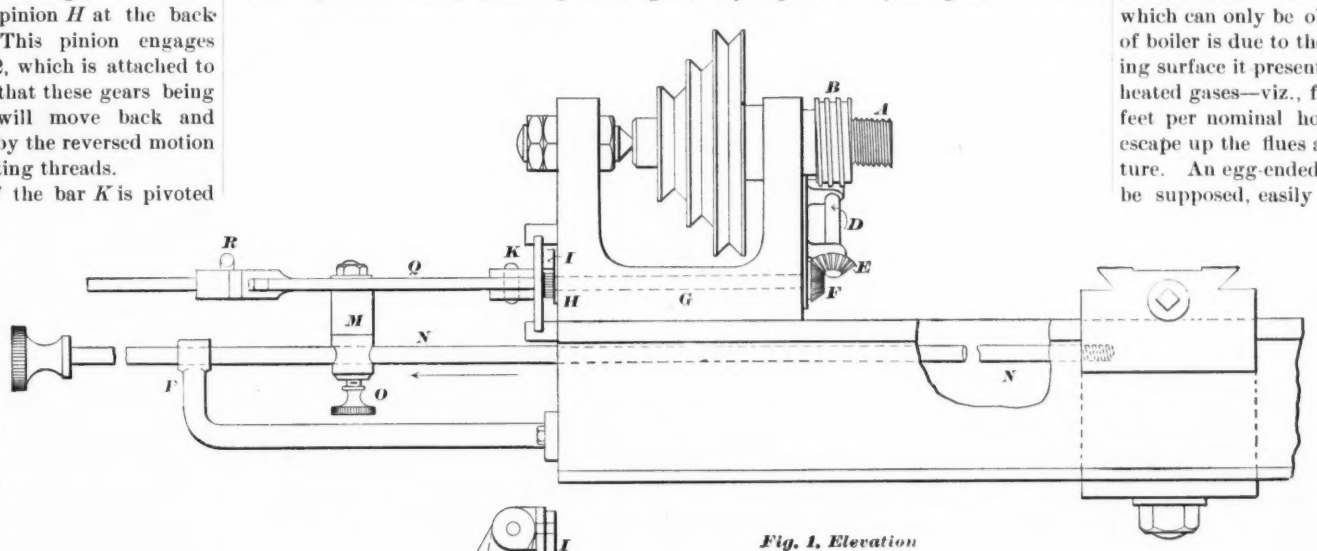


Fig. 1. Elevation

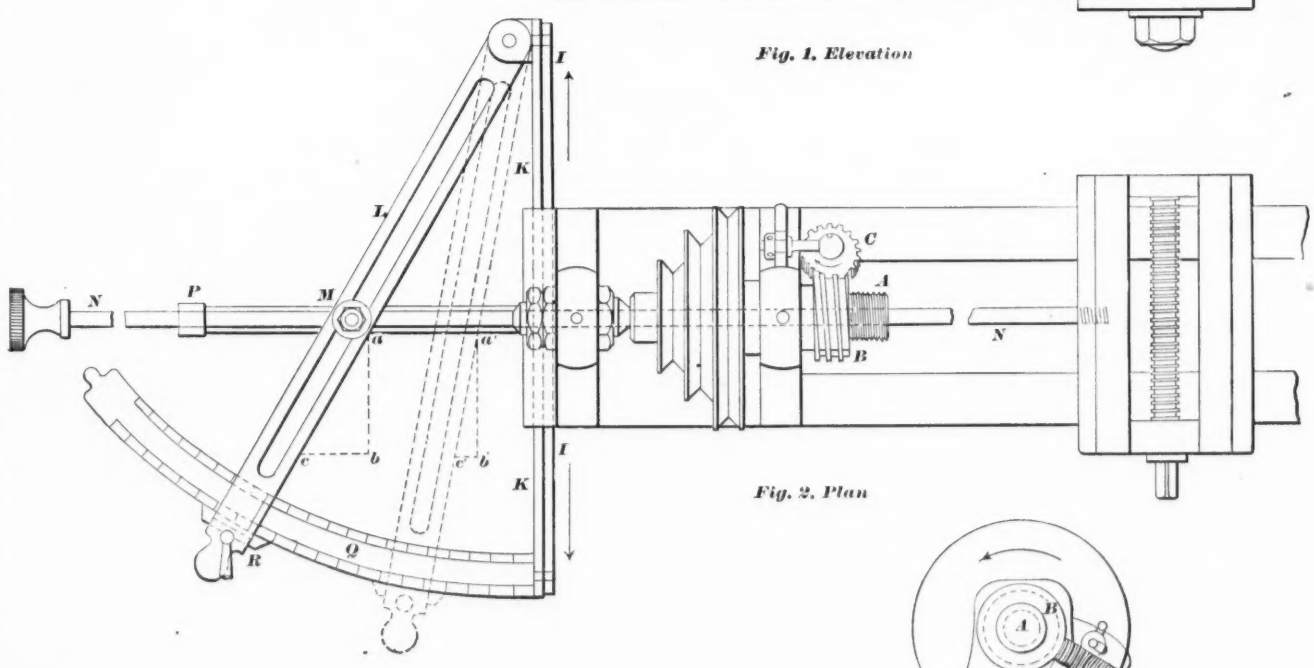


Fig. 2. Plan

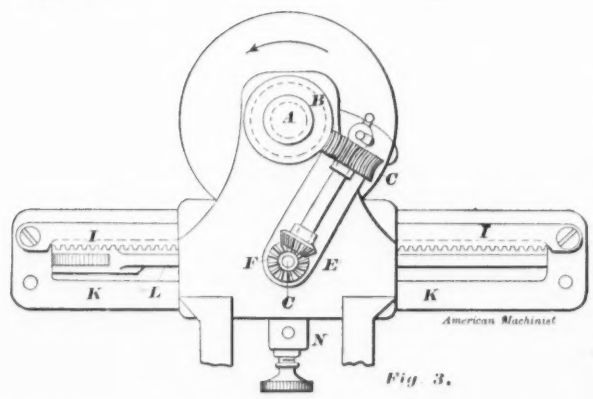


Fig. 3.

The Economical Use of Steam in Colliery Engines.

BY JOHN MCLAREN.

(A Paper Read Before the Federated Institute of Mining Engineers.)

Twenty-five or thirty years ago, mining engineers in Lancashire and the great coal fields of Northumberland and Durham began to realize the waste of fuel which was daily going on in connection with the steam engines in use upon the colliery works with which they were connected. The impression was, no doubt, accentuated by the high prices realized by coal during the few years of abnormal prosperity which followed the great war between France and Germany. As every ton of coal wasted represented a ton less to sell, the lesson of economy was brought home in a very practical manner in those days of very high prices. Consequently, managers were moved to try to introduce improved engines, with the view of economizing their own coal as much as possible. The result was, that a large number of very fine pumping and winding engines were put down in various parts of the country. But as the steam at that time was mostly generated by the old-fashioned and wasteful egg-ended boiler, the action of the colliery engineers in putting down fine engines looked rather like beginning at the wrong end. However, the question of boilers also came to be considered, and now the egg-ended pattern is rapidly becoming obsolete, and its place is being taken by more economical steam generators. Nevertheless, there is still much room for improvement, as any one can see who observes the way steam, and consequently fuel, are wasted, by continuous blowing off from the safety valves of colliery boilers, as well as by its extravagant use in improperly constructed engines. Although this paper is intended to deal principally with engines, the question of boilers is too important to be passed over without comment. The most useful and practical forms of steam boiler are sufficiently well known to require no detailed description. The egg-ended boiler, which happily promises to become speedily extinct, was in almost general use twenty-five years ago. Its cheapness in first cost is dearly purchased by its extravagant wastefulness of fuel. The low evaporative duty which can only be obtained from this type of boiler is due to the small amount of heating surface it presents to the action of the heated gases—viz., from five to seven square feet per nominal horse-power—which thus escape up the flues at a very high temperature. An egg-ended boiler is not, as might be supposed, easily or cheaply kept in repair, and, as a large percentage of them ultimately explode, causing serious loss and damage, they are in the long run the dearest type of steam boiler which can be employed. They are being rapidly displaced by Cornish and Lancashire boilers, which not only give double the amount of heating surface per nominal horse-power, but such area, consisting largely of internal flue surface, is more valuable from a steaming point of view than much of the heating surface of an egg-ended boiler. The proportion of heating surface in these boilers is about fourteen square feet per nominal horse-power.

Tubular, or water-tube boilers, are largely used on the Continent and in America, and they are coming into somewhat limited use in this country. Their economy, however, is doubtful, and in actual tests a great disparity in results has been noted, the evaporation varying from 7 pounds to 10 pounds of water per pound of coal; but even with the higher evaporation, their economy is not by any means established, as it is well known that their construction induces priming to a greater or less extent, so that the duty obtained from the boiler is more real than apparent. In priming, the steam, of course, carries a certain amount of water in the form of fine spray in suspension, which is an absolute disadvantage to the engine, though it makes the evaporation of the boiler appear very good.

A NOVEL SCREW-CUTTING DEVICE.

The locomotive type of boiler is, however, unquestionably the best and most economical steam generator in practical use. It has also many other advantages, which should have secured for it a much more general adoption than it has been hitherto accorded. It requires no expensive brickwork seating, but can be set down on a few flags or bricks laid upon the surface of the ground. The whole of its external surface can be covered with non-conducting material, which can be readily removed for complete examination and repairs. It presents at least 20 square feet of heating surface per nominal horse-power. It can be stayed so as to be absolutely safe at pressures up to any practical limit. It occupies the least space of any boiler in proportion to its power, and gives the extremely high evaporative duty of over 11 pounds of water per 1 pound of coal. They can be made up to 100 nominal horse-power each. There is an unreasonable prejudice against these boilers in the minds of some steam users, owing to their supposed greater wear and tear, though in practice they will be found to cost no more in the long run for repairs than Cornish or Lancashire boilers doing equal duty. The efficiency of a boiler is estimated by the rapidity with which it generates steam, and the smallness of the amount of the fuel with which this result is attained. Measured by this standard, the locomotive type of boiler must take the very first place.

The evaporative efficiency of the different types of boiler may be stated approximately as follows: Egg-ended boilers, 4.6 pounds of water evaporated by 1 pound of coal from and at 212° Fah.; Lancashire boilers, 8 pounds of water evaporated by 1 pound of coal from and at 212° Fah.; tubular boilers, 7 to 10 pounds of water evaporated by 1 pound of coal from and at 212° Fah.; locomotive type boilers, 11 pounds of water evaporated by 1 pound of coal from and at 212° Fah. The most perfect boiler and the best steam engine are, however, but clumsy and extravagant instruments for the conversion of heat into work. Each pound of good Welsh coal contains over 16,000 units of heat. Each unit of heat is theoretically equal to 772 foot-pounds, so that the theoretical value or duty of 1 pound of coal is 12,537,280 foot-pounds, or about 6¼ horse-power per hour. Hitherto it has been found impossible to construct engines and boilers capable of giving off anything like the amount of work corresponding with the theoretical value of the coal. In the best authenticated experiments the highest economy attained has been 1 horse-power for a consumption of 1.35 pounds of coal, or only about 11.75 per cent. of its theoretical value. But as the vast majority of high-pressure steam engines are burning from 5 to 8 pounds of coal per indicated horse-power they are only utilizing about 2 per cent. of the theoretical value of the coal. This loss is sufficiently serious, without its being unnecessarily increased by continuously blowing off steam from the safety valves, losing heat by radiation from uncovered boilers and steam pipes, or allowing boilers to prime, and thus wasting water and heat, and damaging the engine at the same time. It is thus manifest that the waste of fuel supplied to the steam engines of this country must be measured by millions of pounds sterling per annum; so that it is to the interest of all users of steam power——colliery owners included—to economize wherever possible. Mechanical engineers have, therefore, in recent years devoted much attention to the design of high-class steam engines and boilers, in which the waste shall be reduced as much as possible. Some of these designs have involved much complicated mechanism for the working of the valves, which, while effecting to a greater or less degree the desired end, have introduced another element of expense and waste, in the complication of the mechanism required.

Many claims of extraordinary economy have been put forward on behalf of one or other of these various forms of engines or valve gearings, but unless the figures so given are vouched for by a qualified and independent engineer they must be received with the utmost caution. The omission, intentional or otherwise, of what might appear trifling observations might easily make all the difference between a phenomenally good and a merely average result. Instead of instituting comparisons, however, which could scarcely fail to look invidious, it may be better to refer to a series of trials which were carried out in the works of the author at Leeds with a set of triple-expansion engines, from which very remarkable results were obtained. There was nothing special in the design or construction of the engine, except that the greatest attention and care had been bestowed upon the proportions of the various parts. The figures would appear to show that, when sufficient care in construction is exercised, the same economy can be obtained with engines and valve gear of the stereotyped pattern as has been considered only obtainable with complicated and expensive valves and valve mechanism.

The difference, for instance, which a proper proportion of steam passage will make is simply incredible. A case came under the notice of the writer a short time ago, in which the steam ports of a compound locomotive by one of our best British makers were so small, that the power absorbed in expelling the exhaust steam from the low-pressure cylinder amounted to about 10 per cent. of the whole power of the engine. The ports were so small that, after the steam had done its work in the cylinder, it could not escape fast enough to keep out of the way of the piston on its return stroke, consequently the latter, impelled by the higher pressure on the other side, had to act as a force pump, forcing out the steam, which, of course, exerted a considerable back pressure, and absorbed a proportionate amount of the useful energy of the engine.

The triple-expansion engine and locomotive boiler upon which the following experiments were made was one of three exactly alike, constructed to the order of the Central Argentine Railway Company, for the electric lighting of the workshops, etc., at Rosario. They are, of course, equally suitable for any class of work, such as driving ventilating fans, pumping, compressing air, or other continuous work at coal or other mines. As coal at Rosario costs 70s. per ton, the advantage of economical engines is obvious. The engines in question were of the vertical inverted cylinder pattern, marine style, surface condensing, with cylinders 9 inches, 14¼ inches, and 22½ inches diameter by 2 foot stroke, working down on a three-throw crank set at angles of 120 degrees, the high-pressure crank leading. The high-pressure and intermediate cylinders are jacketed with live steam supplied direct from the main steam pipe. The condensed water from the jackets is allowed to escape through Macdougal's patent steam traps, and was carefully measured at the trial. The slide valves are what is known as the Trick pattern, being a modification of the well-known D-valve. They are each worked by a single eccentric from the crank-shaft. The admission of steam to the high-pressure cylinder is regulated by McLaren's improved governor and automatic expansion arrangement combined, by which the steam can be cut off at any point from 0 to .75 of the stroke, the lead remaining constant, notwithstanding variations of the cut-off. The condenser is fixed horizontally at the back of the engine, and consists of an upper and lower division separated by a diaphragm plate, but connected at one end, so that the exhaust steam is well distributed amongst the condenser tubes. These are of brass, communicating with water boxes at each end, and the water for condensing circulates through inside of the tubes, the exhaust steam being brought into contact with the exterior surface. Air pump, circulating pump, and feed pumps are fixed behind condenser, and worked off a crosshead which is driven by a couple of sway beams worked off the crosshead of the intermediate piston rod. The whole of the oiling of the moving parts is done from the platform at the back of the cylinders, and is arranged so that the engines can work continuously without stopping for oil.

As it was intended to make exhaustive trials of these engines the fly wheels were made with a groove or trough inside the rim, into which cold water could be run to prevent the rim of the wheel getting too hot by the friction of the brake. Automatic skimmers were fixed in such a position as to carry off the superfluous water from the fly wheel rim. Indicator gear was fixed on each cylinder, but instead of one indicator being fixed at each end of each cylinder, only three instruments in all were used, viz., one on each cylinder. T-pipes were used, one branch being carried to the top and the other to the bottom, the indicator being fixed on the center. This was very unfortunate, as a considerable loss of indicator power was thus sustained. It has been found by actual experiment that this arrangement may involve a loss of as much as 8 per cent., as compared with having the indicators close up to their work at each end of the cylinder. Unfortunately, at the last moment, although plenty of indicators were at hand, it was found that several springs were wanting; and as it was not convenient to postpone the trial, the best had to be made of the apparatus immediately available. The boilers are of the multitubular type, steel throughout, barrel 4 feet 10 inches diameter, 11 feet 1¼ inches long, over tube plates, containing 106 tubes, and presenting 880 square feet of heating surface with 26 square feet grate area. It was fired by hand. The whole was covered in, to prevent as far as possible any loss of heat by radiation. As the results obtained in previous trials with the same engine were so exceptionally good, it was determined to ask Professor Goodman, of the Yorkshire College, and Mr. Wilson Hartnell, of Leeds, to run an independent test, so that the figures published might be accepted as above suspicion. These gentlemen accordingly took charge of the engines for a four-hours' run, and with a large staff of their own assistants made a complete test, from which the following figures and remarks are copied:

Method of Experimenting—Indicated Horse-power.—Indicator diagrams were taken at intervals of fifteen minutes, by means of Crosby indicators, which were driven in the usual method by quadrants attached to a rocking shaft. The springs used were $\frac{1}{120}$ for the high pressure, $\frac{1}{40}$ for the intermediate $\frac{1}{120}$ for the low-pressure cylinder. The brake horse-power was measured by means of a brake, consisting of a broad colliery rope 6 inches wide, wrapped round the upper half of the fly wheel; from one end of this rope a dead weight—946 pounds—was suspended, the other end being provided with two Salter's spring balances. The equivalent load on the brake was 940.35 pounds, acting at a radius of 4.91 feet. A jet of water was allowed to play into the trough-sectioned rim of the fly wheel, in order to keep it cool. The brake, which ran remarkably steady during the whole trial, was occasionally lubricated with a little tallow. The feed water was measured by means of two tanks, which were previously gauged by filling with weighed water of the same temperature as the feed. The jacket water was also measured in a separate tank, gauged in a similar manner to the feed-water tanks. There was a loss of some 6.92 per cent. between the feed water supplied to the boiler and that obtained from the hot well, the balance made up by an auxiliary supply weighed in the same manner as the feed and jacket water. This loss, we may add, is always found in surface condensing engine trials, and does not show that any error occurred in the measurements. The revolutions of the engine were recorded by a Harding's counter, and were checked by counting once in every quarter of an hour. The mean revolutions thus obtained agreed perfectly with those recorded by the counter, the speed was remarkably constant, the revolutions only varying between 120 and 122 per minute during the whole trial. The coal was carefully weighed out on a new Denison's weighing machine, and supplied to the firemen in boxes containing 112 pounds each. The amount of fire on the bars was estimated at the beginning and brought to, as near as possible, the same condition at the end of the trial. A sample of the coal was dried, but it was only found to contain an inappreciable quantity of moisture. The water in the gauge glass was carefully noted at the beginning of the trial and brought up to the same point at the termination.

The temperature of the escaping gases in the smoke-box was taken at intervals, also the amount of draught by means of a water gauge. Everything in connection with the engine and boiler went remarkably smooth and regular during the whole trial, which lasted about four hours. Before commencing the trials all the pipe connections and valves were carefully examined, to insure that no leakages or other irregularities should occur. The engine was allowed to run for about one hour before the actual trial took place. Observations were taken every quarter of an hour by our own staff of assistants. The purchasers of the engine also had a staff of their own taking similar observations quite independently of our own. The indicator cards have all been measured twice by means of a planimeter, and the whole calculations carefully checked. The results of the trial were as follows:

1.	Duration of trial		4.1 hours
2.	Indicated horse-power.	High-pressure cylinder	39.27
3.		Intermediate cylinder	42.04
4.		Low-pressure cylinder	40.54
			121.8 I. H. P.
5.	Brake horse-power		106 9
6.	Mechanical efficiency, per cent		87.7
7.	Revolutions per minute		121.6
8.	Steam pressure in boiler (above atmosphere)		157 lb. per sq. in.
9.	Steam pressure in boiler, absolute		171.2 "
10.	Vacuum in condenser		28 in.
11.	Feed water used per indicated horse-power per hour, including jackets		13.6 lb.
12.	Feed water used per brake horse-power		15 5 lb.
13.	Steam used in jackets per indicated horse-power per hour		1.35 lb.
14.	Steam used in jackets per brake horse-power per hour		1.41 lb.
15.	Coal burnt per indicated horse-power per hour		1 35 lb.
16.	Coal burnt, exclusive of ash		1 33 lb.
17.	Coal burnt per brake horse-power per hour		1.53 lb.
18.	Coal burnt, exclusive of ash		1 51 lb.
19.	Water evaporated per lb. of coal from a mean temperature of 110 deg. Fah.		10.11 lb.
20.	Water evaporated per lb. of coal from a mean temperature of 110 deg. Fah., exclusive of ash		10.26 lb.
21.	Water evaporated per lb. of fuel from and at 212 deg. Fah.		11 34 lb.
22.	Water evaporated per lb. of fuel from and at 212 deg. Fah., exclusive of ash		11 51 lb.
23.	Coal burnt per square foot of heating surface per hour		0 186 lb.
24.	Mean temperature of smoke-box		460 deg. Fah.
25.	Vacuum in smoke-box		⅛ in. of water
26.	Heat taken up by feed water per minute		29,930 thermal units
27.	Heat turned into work per minute		5,206 "
28.	Thermal efficiency of engine, per cent		17.4
29.	Heat rejected in circulating water per minute		23,400 thermal units
30.	Difference due to radiation, etc		1,164 "
31.	Difference due to radiation, per cent		3.89 "

It may be of interest to note that the weight of steam shown by the indicator cards in the three cylinders is approximately 0.079 pound, 0.090 pound, and 0.068 pound at the beginning, and 0.080 pound, 0.092 pound, and 0.074 pound at the end of the stroke in the high-pressure, intermediate and low-pressure cylinders respectively. The weight of feed water used per stroke being 0.114 pound.

Accounts that we have recently published of tests, from quite different parts of the world, go to show, from the similarity of results, that the economy of triple-expansion engines is pretty fairly known. When the variation is less than a pound of steam per horse-power per hour, things are getting down towards a science, and the indications are that but little better economy is to be expected than has already been had from this type of engine. The triple-expansion engine has shown an advantage, as compared with the two-cylinder compound. The next serious attempt will be to determine the advantage of four-cylinder compounds.

Oil Production.

A Toledo, Ohio, dispatch says: "The report of operations in the Ohio oil fields for July shows that there were 144 wells completed, with a daily new production of 8,461 barrels, and 19 dry wells. This is an increase of one completed well and one dry hole over June, while the new production shows an increase of 1,794 barrels daily. In new work there are 90 wells reported drilling, 137 rigs up and building, being an increase of 14 rigs over June, while the drilling wells were the same as for June. The feature of the month's work was the drilling in of what is said by oil men to be the largest oil well in the world. When drilled in there was an indicated capacity of 40,000 barrels a day. The well, which is the property of the Ohio Oil Company, is located in Hancock County. It is shut in, and only a limited quantity is taken from it daily.

"The first report of operations in the Indiana oil field, which is now attracting considerable attention, shows that work is confined to wells in Adams, Blackford and Joy Counties. Four wells were completed during the month just ended, with a total production of 253 barrels daily. Five wells drilling, seven rigs up and building."

The Effect of the Steam Jacket on Cylinder Condensation.

BY W. W. BIRD, CAMBRIDGEPORT, MASS

(A Paper Read at the Providence Meeting of Mechanical Engineers.)

The object of this paper is to show something of what is being done at the Mechanical Laboratory of the Worcester Polytechnic Institute, in regard to the effect of the steam jacket on cylinder condensation and engine economy, and to add, if possible, something to the general information on these subjects.

The work here presented was done to a great extent by Mr. F. A. Gardner, of the class of 1890, and presented by him as his graduating thesis. The experiments were made on the upright compound engine at the Institute, a further description of which is given at the end of this paper, and the results and conclusions of these experiments are for this engine only.

It is a generally accepted fact that, aside from radiation, all the heat lost in a steam engine is what goes out at exhaust, and, as a certain amount must go out, the real loss is the difference between what does and what should go out. Cylinder condensation is the great cause of this loss, as heat is taken up at a high temperature and given back at a lower, when the opportunity for useful work has nearly if not altogether passed. As all the heat taken up in the cylinder from the entering steam must be returned during the cycle, excepting what is lost by radiation, it is not the loss of heat as heat, but the loss of the opportunity of converting heat into work which affects so seriously the efficiency of the engine.

With these facts in mind it was proposed to investigate the action of the steam in the cylinder in regard to the exchanges of heat: the effect of the steam jacket, and to see if it was a benefit, and if so, why.

Judging from the work done thus far, we conclude that for this engine the steam jacket is a benefit, the steam saved more than making up for that used in the jacket directly. The surfaces of the cylinder are warmer when the jacket is used, thus decreasing condensation to begin with; the steam is dryer at the beginning of exhaust, so that less heat is given up during that period. The steam is probably not homogeneous in the cylinder; the condensation takes place where it is in contact with the surfaces, forming a film of moist steam, which takes up the heat returned after re-evaporation begins, and the more moisture in the steam the more heat there is taken from the surfaces. And since most of the heat is returned during exhaust, the condition of the steam at the beginning of that period is of great importance in determining the amount of heat to go out and the efficiency of the engine.

The accompanying diagram (Fig. 257) is presented to show graphically the exchanges of heat between cut-off and exhaust, or during the expansion in the high-pressure cylinder. The areas below the base line show heat taken up after cut-off and before re-evaporation begins; the areas above, the heat given back. Horizontal distances represent temperatures, and vertical distances entropy. Thus, if there were no exchange of heat, the curve would coincide with the base line, and the entropy would be constant as it should be with adiabatic expansion.

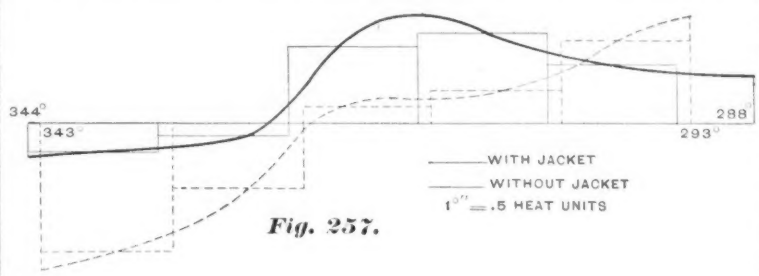
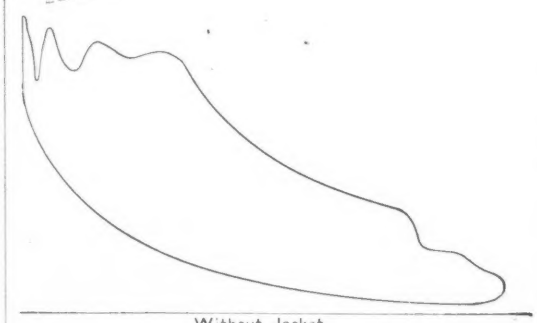


Fig. 257.



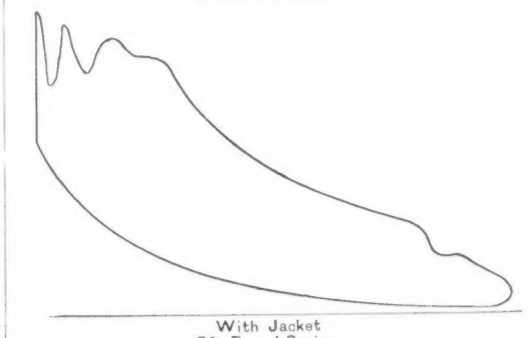


Fig. 258.

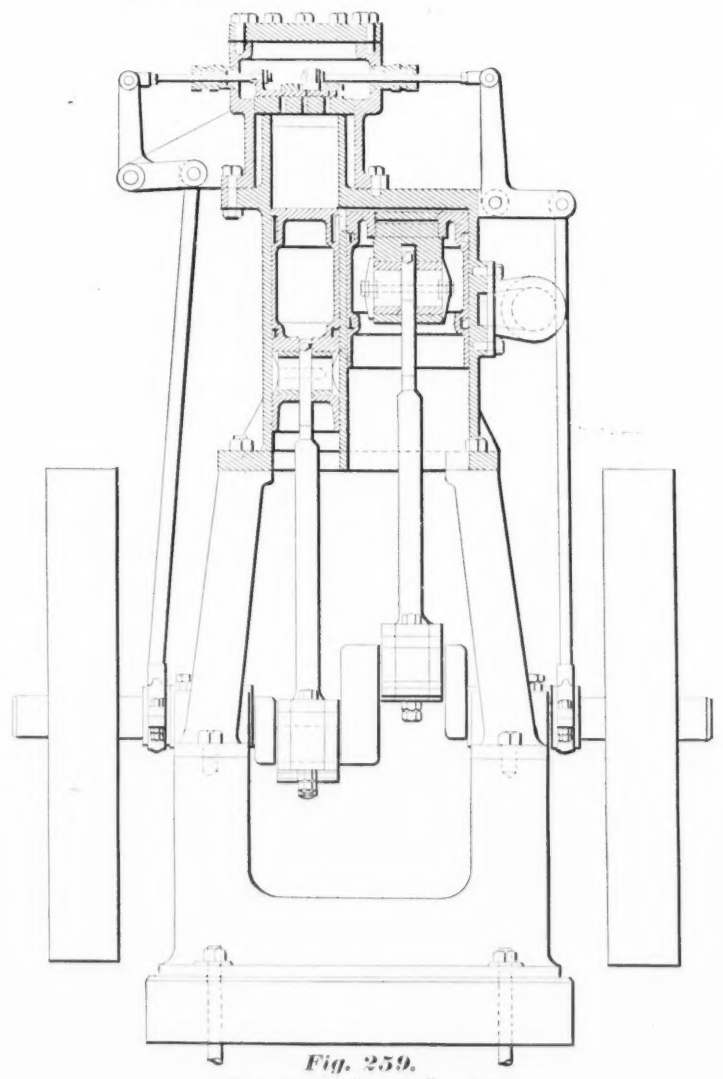


Fig. 259.

EFFECT OF STEAM JACKET.

The method of constructing the diagram is as follows: The range of temperature between cut-off and exhaust determines the length of base line, which is divided into several parts, and corresponding divisions made on the indicator card by taking the different pressures corresponding to the several temperatures. The heat accounted for at each of these temperatures, together with the heat equivalent of the external work of each division, gives the required data for finding the exchange of heat during each period, which is shown by the rectangles, the curve being sketched in afterward to enclose equal areas.

It will be seen by this and Table III that the work is the same as in Hirn's analysis, only applied at more points in the cycle. To obtain the weight of steam and water in the cylinder during expansion the steam was taken as dry in each case at the end of compression, and, as a separator was used, the steam supplied was also taken as dry. These assumptions do not affect the curves relatively to any amount.

The diagram in this case shows that the curve with the jacket is nearer to a straight line than when unjacketed, therefore nearer to true adiabatic expansion, although heat is being received all the time from the steam in the jacket. It also shows that there is less condensation after cut-off when the jacket is used; that re-evaporation begins earlier, after which heat is rapidly returned, thus giving it more chance for useful work; that the amount returned decreases as the steam becomes dryer, so that less goes out during exhaust.

Without the jacket, after re-evaporation begins, the heat is given back apparently quite slowly; this is probably due to the steam coming in contact with new surfaces, as the piston advances, which are cooler; however, the rate increases and is greatest at the beginning of exhaust and the steam is still moist enough to continue to take heat rapidly during this period, thus cooling the surfaces much more than in the other case.

These curves might be continued so as to show the action during the time the two cylinders are in communication or when the high pressure is exhausting, and then during compression. Sufficient has been given to show the method. At some other time, it is hoped to present diagrams showing the effect of time on cylinder condensation and also the effect of superheated steam. Different combinations of these, with and without the steam jacket, will give variety of work and doubtless lead to some valuable information. Fig. 258 shows reproductions of the cards taken with and without the jacket.

TABLE I.

	Average Boiler Press. Gauge.	Revolutions per minute.	Average Cut-off.	Indicated Horse-Power.
With Jacket ..	120	288	.262	10.57
Without Jacket...	120	289	.339	10 53

	Steam per Hour to Engine.	Steam per Hour to Jacket.	Total.	Pounds per Indicated Horse-Power per Hour.
With Jacket.....	180	12	192	18.16
Without Jacket....	224	.....	224	21.37

Gain by jacketing, 14.6%.

TABLE II.

	Steam Admitted per Stroke. Pounds.	Steam Saved by Compression.	Total Weight at Cut off.	Per Cent. of Steam at Cut-off.	Heat in Steam at End of Compression.
With Jacket....	.0104	.0036	.0140	87 59	3.9666
Without Jacket.	.0129	.0039	.0168	84 60	4.2911

	Heat Received per Stroke.	Heat Equivalent of Work Done up to Cut-off.	Total Heat Accounted for at Cut-off.	Actual Heat in Steam at Cut-off.	Heat Taken Up by Surfaces.
With Jacket....	12.3577	.6140	15 7104	14 1120	1 5983
Without Jacket.	15.3280	.8007	18 8184	16 5223	2.2961

	Per Cent. of Steam at Exhaust.	Heat in the Steam at Exhaust.	Heat Equivalent of External Work, Cut-off to Exhaust.	Total Heat Accounted for at Exhaust.	Heat Given Up by Surfaces and Jacket.
With Jacket ...	89 97	14 1291	.7791	13 3329	7961
Without Jacket.	80.60	15 5784	.6810	15 8413	-.2628

TABLE III.

	Range of Temperature.	Total Heat at Higher Temperature.	Per Cent. of Steam in Mixture at Lower Temperature.
With Jacket.....	344.334	14.1120	85 93
" "	334.324	13.8785	84.85
" "	324.314	13.7083	86.54
" "	314.304	13.8502	88.54
" "	304 294	14 0834	89.53
" "	294.288	14.1038	89.97
Without Jacket	343 333	16 5223	80.54
" "	333 323	15.9176	78 27
" "	323 313	15.5429	78.17
" "	313 303	15 4595	78.41
" "	303 293	15.4264	80 00

	Total Heat at Lower Temperature.	Heat Equiv. of External Works during the Range.	Total Heat Accounted for at Lower Temperature.	Heat to or from Surfaces and Jackets.
With Jacket.....	13.8785	.1192	13.9928	—.1143
" "	13.7083	.1173	13.7612	— 0529
" "	13.8502	.1470	13.5613	+.2889
" "	14.0834	.1576	13.6925	+.3408
" "	14.1038	1498	13.8837	+.2202
" "	14.1291	.0881	14.0157	+.1134
Without Jacket...	15.9176	.1030	16.4203	— 5027
" " ...	15.5429	.1099	15.8077	—.2647
" " ...	15.4595	.1409	15.4020	+.0576
" " ...	15.4264	.1605	15.2991	+.1273
" " ...	15.5784	.1679	15.2586	+ 3198

The engine is an upright single-acting compound, 5¼ inch and 9 inch cylinders,

8-inch stroke, and about 10 I. H. P. It was built for the mechanical engineering department of the Worcester Polytechnic Institute, and was installed in the Salisbury Laboratories in April, 1889. The engine is shown in vertical section by Fig. 259, and has the following peculiar features:

I. The cylinders are side by side, but the high-pressure cylinder has its lower end just below the upper end of the low-pressure cylinder, so as to give a direct passage across from one cylinder to the other.

II. The cranks are set 120° apart, the low-pressure crank being 120° behind the other. By this arrangement the high-pressure piston acts as a valve between the two cylinders, and is the only valve required between them.

III. The exhaust port is at the lower end of the L. P. cylinder, and the L. P. piston takes the place of an exhaust valve. By this arrangement the exhaust is performed, not in the usual way, by forcing the steam out during the larger part of the stroke, but by allowing the pressure in the cylinder to drop to that in the condenser. Early on the return stroke the exhaust closes, and the steam remaining in the cylinder is compressed. By this means the work, otherwise done upon the fluid in the condenser during exhaust, is retained in the engine as heat or as potential energy of the compressed steam.

IV. If the compression in the high-pressure cylinder were carried to initial pressure, there would be no loss in that cylinder from clearance on account of unused compressions, as the compressed steam would expand back to the same pressure from which compression begins. The cut referred to does not show the governor, which is an ordinary shaft governor, controlling the eccentric which operates the cut-off valve. The speed at which the engine has been driven thus far is about 290 revolutions per minute. The high-pressure cylinder is provided with a steam jacket. It is clear that the engine is arranged for a high degree of compression in both cylinders.

A Pittsburgh dispatch says: "The record of oil development for July shows an increase of 30 wells completed, and an increase of 1,280 barrels of new production, as compared with the month of June. There was a decrease of 5 dry holes and 52 rigs, and an increase of 13 wells drilling."

Watch Making in France.

It appears from a report made by the Besançon Chamber of Commerce on the operations of the French watch industry, that the anticipations formed in 1889 of an improving course of business were fully realized in 1890. Out of 404,436 watches of French manufacture delivered for consumption in 1890—of which about 30 per cent. were gold and 70 per cent. silver—no fewer than 401,439 were passed by the Besançon Control Office. Foreign watches to the number of 40,911 were passed, as follows: At Pontarlier, 22,557; Montbéliard, 10,986; Bellegarde, 3,859; Paris 2,031; Besançon, 902; and all other offices, 576. Of the total foreign watches, 8,515 were gold and 32,396 silver. As 2,650 out of the 2,743 gold watches passed by the Paris Control Office were of Besançon origin, it thus appears that the extraordinary number of 404,089 out of 404,436 watches, partly consisting of precious metals manufactured in France last year, stand to the credit of Besançon. A comparison of the French watches with the foreign article shows that Besançon supplied 90.70 per cent. of the general consumption in 1890, against 89.51 per cent. in 1889, and 85.45 per cent. in 1888.—*London Times.*

A special to the *Tribune*, from Chicago, says: "Chicago is to have an underground railway at last. Wabash avenue will be undermined, and four steel tracks will be laid therein. At Springfield the Wabash Avenue Subway Transportation Company, of Chicago, filed articles of incorporation with the Secretary of State, with a capital stock of $10,000,000. The incorporators and first board of directors are George W. Cole, Silas Rhodes, J. Warren Pease, Maria E. Beasley and Pleasant Amick. George W. Cole is an attorney.

"'All I know about it,' said he, 'is that there is almost an unlimited amount of capital back of the venture. The tunnel will run from the river at Cass street south to Eighty-third street under Wabash avenue. It will be built of Illinois stone, braced with heavy steel arches, and will be large enough to permit four trains to run at a time. One of the best things about it is that the trains will be propelled by electric motors, and the passengers will not be afflicted with stifling smoke. The stations in the central portion of the city will be at each alternate street intersection, and the trains will be run according to the demand.'"

Worthington Steam Pumps.

Fig. 1 in the accompanying illustrations represents a pump designed to meet the requirements of the United States Navy for steam launch boiler feeders, and is admirably adapted for feeding small high-pressure boilers and similar work. The water end is strong enough to withstand a water pressure of 250 pounds per square inch. The arrangement and design of water valves are such as to add valuable features to the pump. The water cylinder linings and pistons are entirely of composition, and when desired the piston will also be made of composition.

The valve motion, while retaining all the valuable characteristics embodied in the well-known Worthington arrangement, possesses new and important patented features by means of which simplicity and efficiency are obtained to an unusual extent. There are no rock-shafts, and the entire valve motion consists of but six pieces, the most important parts being lubricated by the steam, and protected from injury or derangement from outside causes.

The dimensions of this pump are as follows: Diameter of steam piston, 2 inches; diameter of water piston, 1⅛ inch; length of stroke, 2¾ inches. Capacity, according to speed, two to six gallons per minute, equivalent in capacity to any single-cylinder pump having 1⅛ inch water pistons. For short lengths of pipe the connections are: Steam pipe, ⅜ inch; exhaust, ¼ inch; suction, 1 inch; discharge, ¾ inch. These diameters must be increased as the length of pipe increases. Space occupied, 19½x6½ inches, and 8 inches high. Shipping weight, 60 pounds.

This pump can also be fitted with hand lever attachments for filling boilers after blowing off, and for washing decks, etc. It can be run in any position, vertical or horizontal.

Fig. 2 represents an improved pressure pump, capable of resisting a pressure of 700 pounds per square inch. This pump is designed for driving hydraulic lifts and cranes, cotton and hydraulic presses, for oil pipe lines, mining purposes, and such service as requires the delivery of liquids under considerable pressure. The plungers are connected together by yokes and exterior rods, in such a manner as to cause them to move together as one plunger, so that while one is drawing, the other is forcing the fluid, thus making the pump double-acting. In this design of pump the packing of the plungers is not only very accessible in case of leakage, but different forms and material of packing can be used. The valve boxes are subdivided into separate small chambers, easily accessible and capable of resisting a heavy pressure. The general arrangement shown in the illustration is subject to numerous alterations to adapt the pump to different requirements. The diameter of the steam cylinders of the pump here shown is 12 inches; diameter of water plungers, 4¼ inches; stroke, 10 inches. Capacity, according to speed, 35 to 105 gallons per minute.

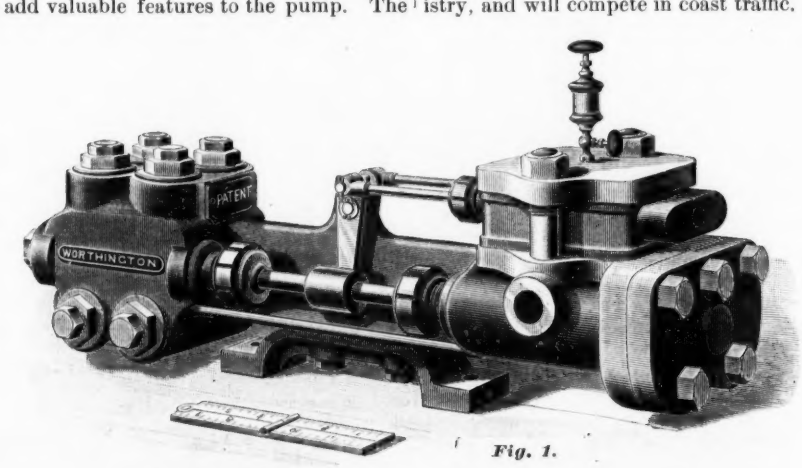


Fig. 1.

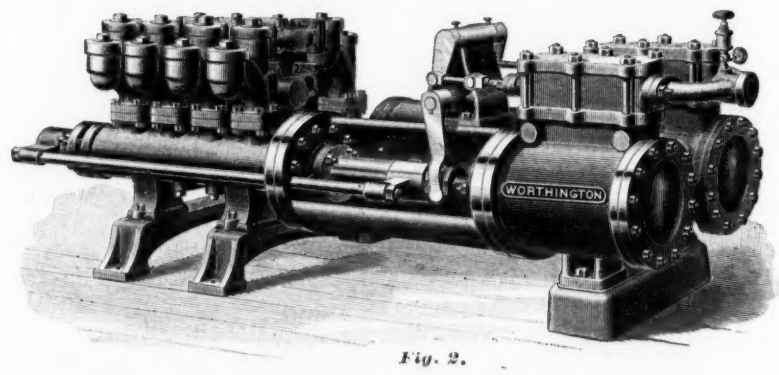


Fig. 2.

WORTHINGTON STEAM PUMPS.

There is considerable consternation due to what appears to be a fact that two foreign vessels have been admitted to American registry, and will compete in coast traffic.

Coil Boilers for the Navy.

In Appendix D of the Annual Report of the Chief of the Bureau of Steam Engineering is the following:

The Navy Department, having in view the possible decrease in weight of machinery in vessels of war by the use of tubulous, sectional, or coil boilers, has determined to adopt such boilers, if suitable can be found, for a portion of the steam power of one or more of the vessels about to be built. To this end, manufacturers who wish to offer such boilers for use by the Department are hereby invited to furnish plans of the same, adapted to an armored coast-defense vessel, on or before September 15. Plans must be accompanied by certificates that boilers of the same make are or have been in successful use at sea or on shore. Plans showing the space in the vessel available for boilers, particulars of the duty required, and other information, may be obtained upon application to the Bureau of Steam Engineering. The boiler which appears to the Department, after investigation, to be the best for the purpose, taking into account the evaporative efficiency, the dryness of the steam, the weight of the boiler, the weight of the water contained, the accessibility for repairs, the ease of making repairs, the simplicity and interchangeability of the parts, the space occupied, the ease of firing and of regulating the feed, the suitability for working in battery, the capability of long-continued steaming without cleaning, and the durability, will be adopted in the coast-defense vessel above mentioned, provided that the price, which must be stated when the plans are submitted, is satisfactory to the Navy Department. Such boilers as appear to possess merit will be tested by the Navy Department, if the manufacturers so desire, to determine which is the more suitable for the purpose. Manufacturers who wish their boilers to be tested must furnish a boiler of the type of one of those proposed for the vessel and prepare it for test, either at their own works or at such place as may be arranged with the Department. The expense of the test of the accepted boiler will be borne by the Navy Department, and the cost of the fuel used in the test of the second best will also be borne by the Navy Department. All other tests must be at the expense of the parties offering boilers for competition.

WILLIAM C. WHITNEY,
Secretary of the Navy.

A curious line was taken by one of the speakers in the deputation of unemployed who waited the other day upon the Premier of Victoria to air their grievances. This man asked Mr. Munro to either find work for the unemployed, of whom he asserted there were some five thousand in Melbourne alone, or to remove the restrictions on the sale of poisons in the Colony, so that the starving creatures could end their misery quickly. Ten of his friends had already poisoned themselves, and he almost threatened the Premier that he would follow their example if work were not speedily found for him. Mr. Munro was only able to give the deputation but poor comfort as far as the finding work for the unemployed is concerned, but he will doubtless see to it that such of the Melbourne loafers and larrikins who need poison can procure it without trouble. It is a painful way out of the difficulty, but it is a way.

We take the foregoing from "The Colonies and India." We do not suppose that the "Premier" can find work for the unemployed in Victoria, any more than the Governor of one of our States could do. But making sport of those who honestly want employment and cannot get it, and who are starving for the lack of it, is a rather sorry basis for fun, "but it is a way."

The Accident to the Naphtha Launch "Ethel."

In our issue of July 30 we referred—not, we believe, in any unfair spirit—to the accident to the naphtha yacht "Ethel." Since then we have received the following communication from Mr. Jno. Amory, secretary and treasurer of the company, which it gives us pleasure to publish:

Editor American Machinist:

In an issue of your paper, July 30th, you comment editorially on the accident to the naphtha launch "Ethel," which was reported erroneously as an explosion, but was found, on investigation, to have been simply an overturning of the launch by mismanagement. Rather singularly, too, the party having the launch in charge was an experienced boatman, who made a business of taking out parties fishing and sailing, and unquestionably, if a pilot's license had been required, he would have passed the examination. It is an odd fact that the few mishaps we have had have generally been where the launches were in the hands of experienced steam engineers and sailormen. There are now nearly a thousand of our launches in use, and the few accidents we have had, as compared with steam launches, have demonstrated pretty conclusively to the unprejudiced observer, that the naphtha launch, in the hands of any person of ordinary intelligence, is safer than steamboats when cared for by licensed engineer and pilot—yes, safer, in fact, than sail or rowboats. GAS ENGINE AND POWER CO.
[New York.]
JNO. J. AMORY, Sec'y and Treas.

A Toronto, Canada, dispatch says: C. H. Dakin, of Halifax, is in town, in the interest of the Terminal City Company, the chief object of which is to establish a new line of steamships on the Atlantic. It is said by the company that the voyage will be reduced to five days, and possibly four, when its new steamships now building on the Clyde commence running.

From Terminal City, Nova Scotia, to Liverpool is only 2,950 miles, while the distance from New York to Liverpool is 3,310 miles. They will establish quick connections be-

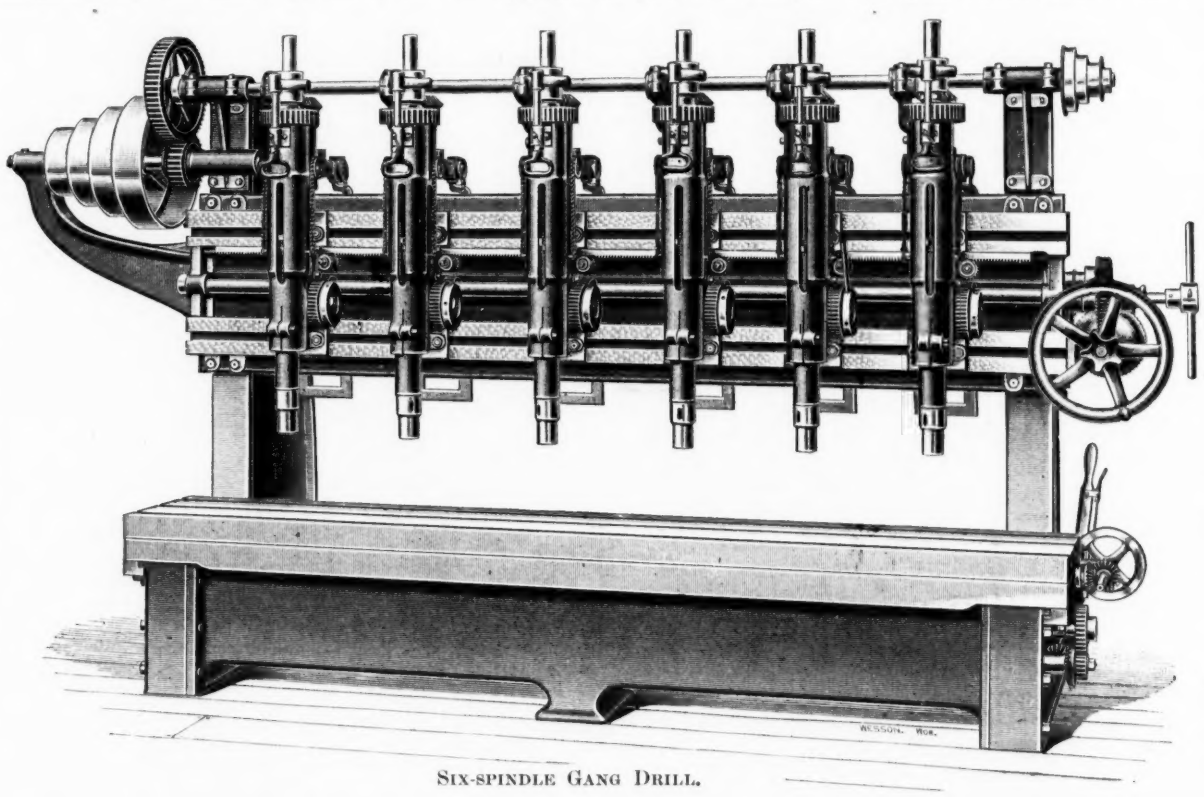
tween Terminal City and New York at Montreal and other points.

If, by fast rail connection, the distance between New York and Liverpool can be reduced to five days, and the time between other points and the English metropolis correspondingly shortened, there is little doubt of the complete success of the new route. Mr. Dakin says that all the space for light freight on the passenger boats has been already bought by a large Chicago shipper.

Six-spindle Gang Drill.

The illustration shows a six-spindle gang drill. Machines of this class, having from two to twelve spindles, are especially serviceable in locomotive, car or boiler shops, or in any work requiring a number of holes at fixed distances from each other. The heads are movable transversely upon the rail. Each spindle is counterbalanced and has independent vertical adjustment, for varying lengths of drills. The spindles are driven by gearing from the top shaft, and controlled by clutches, which are actuated by the handles placed in front of each head in easy grasp of the operator. This machine has hand and power feed, and, by means of the lever shown at the end of the machine, the drills can be instantly lowered to or raised from the work altogether. The feed motion is universal, but any one of the spindles can be disconnected at will. The tables have both lateral and transverse movement. The transverse movement is obtained by means of a hand wheel and screw. The wheel is graduated and provided with a stop. Each graduation of the wheel represents a table movement of $\frac{1}{16}''$, and one revolution of the wheel, a movement of $\frac{1}{2}''$. The lateral movement is obtained by means of a lever and gearing. By this arrangement holes can be accurately spaced. The machine can be furnished with an automatic trip, for determining the depths of drilled holes. This machine is capable of drilling $1\frac{1}{2}''$ holes through six inches of wrought-iron or steel plates.

This machine is made by Prentice Brothers, Worcester, Mass.



SIX-SPINDLE GANG DRILL.

A Chicago dispatch says: "James Goggin, an attorney, says that he has been retained by Canadian relatives of the millionaire, John L. Dubreil, of this city, to test the constitutionality of the celebrated Illinois statute, which was enacted in 1887, to rid the State of alien landlords, particularly Scully, the Irish capitalist, who had introduced into Illinois all the rack-rent usages of Ireland. Dubreil was an American citizen, but his nephew and niece, the contestants, are not, and the widow of the dead millionaire seeks to deprive them of inheritance, pleading the Alien Land act as the basis of her action. This case will be the first test of the law, and the result will affect the tenure of many farms, besides possibly cutting a figure in politics, on account of the prominence given the subject of alien land ownership in the Farmers' Alliance platform."

A Fort Dodge, Iowa, dispatch says: "A three-foot vein of lead ore has been discovered on the farm of J. Halbing, near Breda, in Carroll County. The vein was struck while boring for water, at a depth of 300 feet. Expert miners at Carroll report that the ore is the finest quality of lead ore, and can be mined to good advantage."

Several English journals prophesy that the Chicago World's Fair will be the greatest ever held, all of which tickles our vanity.

Annual Report of the Chief of the Bureau of Steam Engineering.

The Report of the Bureau of Steam Engineering recently issued contains much matter of interest and cause for reflection The Bureau takes some pride, and we believe justly so, in stating that, except for the Newark, which has engines very like those of the Philadelphia, built by the same firm, Concord and Bennington, whose engines are copies of the Yorktown, and the Texas, purchased abroad, all the machinery now building for the navy is from its own designs, and that of the sixteen vessels for whose construction bids have been received during the eighteen months, prior to October 15, 1890, for but two have designs for machinery been submitted by the bidders, and in both these cases the Bureau's designs were adopted; for one of the vessels, because the successful bidder had already adopted them, and in the case of the other, because the Department's plans throughout were thought enough superior to the bidders' to warrant the construction of the vessel on them, the difference in cost of the vessel entire by the two plans being only about 2 per cent. Under the efficient management of the Engineer-in-chief, Geo. W. Melville, the Bureau has during the year prepared plans and specifications for the motive machinery of the following vessels, with an aggregate I. H. P. of 82,300. Coast-line battle ships Nos. 1, 2, 3, of about 9,000 tons displacement each; armored cruiser No. 2, of 8,100 tons; protected cruiser No. 12, of about 7,350 tons; protected cruiser No. 6, of 5,500 tons; Ammen harbor-defense ram. Specifications have also been prepared to be followed by bidders who prefer to submit their own plans of machinery.

Many of the details have been drawn for the machinery of cruisers Nos. 7 and 8, as well as the plans for a large amount of auxiliary machinery.

Plans and specifications of the machinery for the 9,000-ton ships were sent to twelve firms; of the 8,100-ton ship to six; of the 7,350-ton cruiser to twelve; of the 5,500-ton cruiser to nine. Besides these, a number of educational institutions, which give instruction in marine engineering, have been supplied with plans and specifications of several of the Bureau's designs. The increasing demands for such information can be taken as an evidence of the growth of the marine engineering industry in this country, and the dissemination of similar information should be encouraged as much as possible by the Department. All this has entailed a great deal of work in the way of designing, drafting, records, correspondence, etc., and could only have been done, as it was, by the constant and unremitting attention of all the officers and employes of the Bureau, often requiring their presence after office hours, and on holidays.

In regard to the personnel of Engineer Corps, the engineer-in-chief says: "It is with regret that I have now to report that matters are now in still worse conditions than they were a year ago, and that the troubles that were mentioned as likely to occur, are already apparent, for the number of engineer officers now in the service is not sufficient for the proper performance of the duties required of them. All that I have heretofore said can be repeated with emphasis, but in this report I shall call attention to a few of my former recommendations in connection with what will now be presented.

The number of engineer officers on the active list is (up to October 15, 1890,) 202, 4 of them were appointed from naval cadets on July 1, 1890. Among these 202 are 4 who have sent in their resignations, to take effect at the end of leave; 3 are on sick leave, and 1 on leave and engaged on private affairs. Deducting these, there remains a total of 194, of whom 4 have not had the proper engineering education, and 2, at least, did not wish to be appointed in the Engineer Corps.

When my last report was published, but one ship (the Yorktown) with modern machinery had been commissioned; since then, three others (Baltimore, Charleston, Philadelphia) have been placed in regular service, each with one or two less engineer officers than they should have for safety and efficiency, and less than they would have if the corps was sufficiently large to permit the proper detail, but still more than will be possible when the number in the corps has been reduced to the legal limit of 170. As has been foreseen, the worry and anxiety undergone by these officers in their endeavors to keep things going and in order, with the insufficient number of trained men at their disposal, has proved too much for some of them, and they are breaking down. A policy which leads to such results can only be productive of disaster to the service. It requires a very simple calculation to show that the present legal numbers in the Engineer Corps will not be sufficient to properly officer the ships now in commission, and those for whose construction appropriations have already been made, and this without taking into account the number required for shore duty, and to provide for sickness and an occasional leave, etc. Something must be done, and done promptly, or we shall not only have some serious breakdown to repair which might have been avoided, but also an accident more than likely to be attended with loss of life.

We not only need a very much larger number of officers in the Engineering Corps, but we also need a very much better course of instruction for the young men who are each year appointed into it. It is sometimes asserted that educated engineer officers are not needed for sea duty; that practical mechanics can do the duty just as well. Such statements can only be made by the assurance of ignorance. To separate the sea and shore duties of the Engineer Corps into two distinct branches will entirely destroy the excellent system which is the result of years of experience and trial, and which this Bureau has always claimed as best for the efficiency of the navy; that is, the combination of the designer, builder, and competent user of machinery; for it is only by the actual working of the machinery at sea that many defects, either in design or construction, become apparent, and it is only when the experience gained by careful supervision and observation is afterwards intelligently applied to other designs that the same or similar defects are avoided and improvements introduced. No better proof of this is needed than is shown in the case of two new ships added to one of the great transatlantic lines. The original intention was to have them precisely alike, but one is completed some time before the other, and makes two or three trips, and immediately the chief engineer points out an improvement that can be made in some detail or some arrangement, and the dock (or superintending) engineer of the line directs it made in the sister ship. When the second vessel comes out she invariably "breaks the record" of the first one. Now, both the superintending and the chief engineer referred to have climbed up to their positions by means of the engine-room ladder. 'Practical mechanics' would have kept everything in good order, and perhaps have improved the adjustment of parts; to have improved the economy of the system, by which alone any appreciable increase of speed and decrease of running expenses could be obtained, would not have occurred to, nor have been understood by them. It is a very simple thing to make a design, but to say which parts of that design shall stand, and which be altered to insure desired result requires the skill, training and experience of the engineer.

There is still another and very important point that is generally overlooked when considering the Engineer Corps of the navy, and that is that they are a part of the military organization, and second to none in importance. In the naval battle of the future, the engineer staff will have a difficult and important part to perform, and if there is failure in the engine-room, no amount of skill and bravery on the bridge may suffice to avert disaster. Celerity of movement has decided many a naval battle, and will decide many more, and the celerity of movement of a modern ship depends directly on the skill of her engineer officers."

The report also shows that the number of enlisted men and petty officers in the engineering force is not sufficient for the requirements of the navy, and this, as well as the incompetency of both petty officers and men, has been the cause of constant complaints from the new ships. Many good recommendations for the training of the men are made, and they should be adopted if our navy is to hold its own with others. Comments on the report are unnecessary; it clearly sets forth the results which may be expected if Congress does not give attention to the matter.

It is believed that a recent court decision in this country, fixing the rights to storage batteries, will result in opening up several lines of electric roads.

LETTERS FROM PRACTICAL MEN.

Babbitting Large Bearings.

Editor American Machinist:

Replying to Question No. 324, regarding the babbitting of large bearings, you say, "All there is to it is to line up the shaft in its bearings, close up the ends of the bearings with clay, and pour in the babbitt metal."

I do not hesitate to say that there is a great deal more to it that the above answer does not cover, and a person could follow those directions faithfully, and make a dismal failure. The babbitting, properly, of large bearings requires about as good judgment as any job about the shop. Any moisture about the bearing, which the hot metal can come in contact with, is almost sure to cause an imperfect job, if not a total failure, and some plastic material, containing oil instead of water, is entirely superior to clay in all respects. It was formerly the practice to cast the bearings with a narrow ring at each end, to which the shaft was fitted, and this held the shaft in position while being babbitted, but as the cast-iron rings wore grooves in the shaft it has been almost entirely abandoned on large bearings, and the shaft or mandrel must be supported by other means, while the bearings are poured. This leaves an open space at each end and along the edges of the bearing, which must be covered to keep the metal from running out, and as this space varies from ¼ inch to ⅜ inch, it is best to have cast iron flanges or collars fitted to the mandrel easily, so they may be adjusted up to the ends of the bearings to hold the metal. In the absence of iron collars, smooth pieces of board may be cut to fit the mandrel snugly, and to keep the metal in along the edges of the bearing, flat strips of wood fitted in and securely held will answer.

It is important to have air vents at all places where air will be confined by the rising metal; it does not do to depend on the air all escaping at the pouring gate, for it will not do so unless the gate is about double the width of the entering stream, and even then the escaping air disturbs the even flow of the ingoing stream of metal, and prevents it running smoothly. It is therefore always necessary to have at least one air vent or riser at the highest and farthest point from the pouring gate.

In pouring large bearings, another point that must be attended to is to secure the stopping collars or boards so the hydraulic force of the liquid metal at the lower parts of the bearing cannot force a leak. This is a common mistake of beginners, and it pays to make everything so secure it cannot possibly get away, and it takes something besides clay or plastic material to do this.

If it is desired to pour the bearing smooth enough to be used without boring, then it will be best to heat the mandrel before pouring, so it is about as hot as can be made without the surface beginning to color. If this cannot be done, it helps some to coat the mandrel with carbon, deposited on the surface by a smoky lamp, or some other non-conducting coating, so the hot metal does not come in immediate contact with the cold mandrel.

And lastly, it is important not to have the metal any hotter than is necessary to make it flow to all parts of the bearing without chilling, for the hotter it is the more it shrinks in cooling, and also the more rapidly does oxide form on the surface of the metal, and cause rough spots on the surface of the bearing.

Covering the surface of the metal in the ladle with pulverized charcoal helps to prevent oxidation, and it can be kept back by a stick when pouring, to prevent it getting into the bearing.

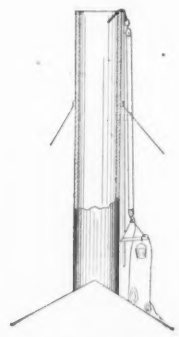
Various shaped slots and holes have been used to secure the babbitt in place in bearings, and I know of much money having been spent in the attempt to hold the babbitt securely in large bearings by simply casting it in, but owing to the shrinkage it was found to be not practicable, and in nearly all large bearings the babbitt is hammered or pened after it is cast in place, and then bored to fit the journal.

It is often necessary to re-babbitt bearings after they are worn down, and they cannot be bored without great expense, so in a case of this kind the best way of securing the babbitt I have seen employed is to cut slots in the casting at each end and along the edges of the bearing, making them dovetail in section, and wedge-shaped, with the narrow end toward the center of the bearing surface, so that when the babbitt shrinks it will pull toward the narrow end of the slot and become tighter. I have used this plan with fair success on bearings eight inches diameter.

All the foregoing refers to bearings made in halves with caps or quarter boxes. Some of the smoothest and best bearings I have seen were made without the use of any clay or other like material, and this was accomplished by having the collars and strips of wood fitted closely enough to prevent the babbitt from leaking out.

When moisture is suspected to be present where the hot metal will come in contact with it, trouble may be obviated by coating the surfaces with oil, but whatever may be necessary, do not use wet clay anywhere if it can possibly be avoided, and, when it is used, do not put it where the hot metal will run against it.

BELL CRANK.



Painting a Smoke-stack.

Editor American Machinist:

In your answer to No. 313, C. W., N. Y., July 16th, you advise him to build a scaffold for only a 50-foot stack. Now if C. W. will go down on the wharves of New York, and size up some "tar," and unfold to him the following plan, and after the description he offers him $10 for the job, he may expect his stack painted in less than four (4) hours, and the "tar" will make $5 an hour, actual time painting:

Take a piece of ¾" round iron about 3 feet long, weld an eye in one end (1½" hole in eye), about one foot from eye make a bend, and bring back end until it forms an angle of about 30° (the crown of bend depends whether the stack is lined or not, and should be made amply large). Rip out on saw three pieces of 1" or 1½" pine, 16 feet long—one piece 2½" wide (bottom), one piece 2" wide (middle), one piece 1½" wide (top); these screwed or nailed together will form a pole. On the small end lash the hook fast, eye down. In the eye having been placed a two sheave block, lashed with marline around hook to secure it, now a one-sheave block, and sufficient fall for the height, you are ready to hoist. Hook block and fall all up, and hook it over the top of stack, and leave it there until done painting. A pair ⅝" block and fall are used, previously run out to lighten, and reach bottom. Form a boatswain chair out of a piece of 1¼"x7"x30" pine, using ⅞" or 1" rope for sling, to the bottom of which is fastened a pail with long rope ½" to hoist and lower for paint. A whitewash brush 6" or 8" face, and handle 10 to 12 feet long, completes the outfit.

The operator seats himself on the chair, hoists himself to within easy reach of top (12 feet will do) and makes fast. He then swings himself around the stack about one-fourth (¼) the diameter, and paints all he can reach, up and down, using his knees and toes on the side of the stack to move himself around. It is surprising how far one can go around (an expert at it), or a boy attending paint may pull him around with the paint-pot tail rope; then he returns and swings around the other quarter and paints, leaving the part immediately over and around last. Lowering himself, he swings and paints as before, and finds he can swing himself almost half (½) around without the boy's help. He can paint a 50-foot stack in three (3) sittings, and finish from the roof of building.

The accompanying sketch will make the rigging clear to our friend "C. W.," and it is not necessary to show the "tar" up there toeing it around the stack.

H. G. R.

About Making Proper Allowances in the Construction of Machinery.

Editor American Machinist:

We always hear considerable said about the difference between theory and practice. There are different kinds of theory. There is the pure natural theory, unaffected by contact with practice, and there is the same natural theory that has been trimmed and refitted, and the sharp corners well rounded off by years of hard experience. The pure natural theory says that a lathe will turn a piece of work round, and there is no quality of round known to it but a *perfect* round. The modified theory does not say anything about perfection, for it has got over that. The pure natural theory says that twice two are four, and does not make any distinction between this calculation and one to find the whole length of two pieces laid end to end, each supposed to be somewhere near two inches long.

We can usually find enough correct theory, but we can't get theoretically correct practice; and besides this, we have no use for absolutely correct practice, but only as near as we can appreciate, and that is not so very near sometimes. When pure natural theory tries to handle ordinary practice there is always considerable friction, for things don't fit, and so there is need of either fitting the practice to the theory, or the theory to the practice. To fit the practice to the theory very near, in many cases, is a very costly operation, and besides being costly, it is a very foolish operation. In designing machinery, besides getting things nice, considerable attention should be given to designing so as to be easily made. Now to commence with, I wish to speak of the different forms of screw threads. There is the plain V thread, which in theory calls for dead sharp points; and there is the U. S. standard, which calls for the top and bottom to be flattened for one-eighth of the pitch, and the *theory* calls for perfection and nothing less; the Whitworth's thread, with its round top and bottom and an angle of 55°, and then the Canada thread, with the same round top and bottom and an angle of 60°.

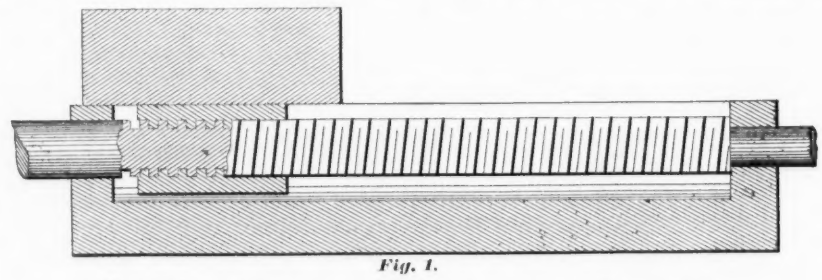


Fig. 1.

PROPER ALLOWANCES IN THE CONSTRUCTION OF MACHINERY.

Now all these standards call for perfection, and so they call for something they can't find, therefore the call is a wrong one. A friend of mine says that the U. S standard is the best, for it does not weaken a bolt so much as a V.

In the AMERICAN MACHINIST of June 4, Chip's man Thompson shows us that a bolt of one square inch cross-section, of good iron, will bear 50,000 pounds; but in practice, for flaws in the iron and things that are not known of, a safe load would be 2,000 pounds.

We see here considerable leeway. The bolt should be capable of bearing twenty-five times more than it has to bear, therefore the difference that a bolt is weakened by having a V thread cut on it, or a U. S. standard, may be overlooked. We would not guess at 100 feet of a distance and then measure the last ¼ inch in thousandths.

I claim that all these standards for screw threads are incorrect. There should be a clearance at top and bottom on all screw threads. I believe it is good practice in the instance of a U. S. standard thread, of say 4 P., to cut the screw and nut with 5 P. tools, so that there will be a little clearance at top and bottom, thereby insuring a good bearing on the sides of thread.

Now if it is good practice to do this, why is this not made the standard?

A screw thread, with a slight clearance at top and bottom, is not quite as strong as without it, but if it is strong enough it is all that is needed. If there is any doubt about this little clearance causing the thread to strip, or the bolt to break, then a larger bolt is needed, or more thread in the nut is needed.

I claim that for ordinary bolts that a plain V thread answers all purposes, when made in the ordinary way, and that this ordinary way should be the standard, instead of the theoretical standard that many aim at but never reach.

Did anybody ever see a V thread, with dead sharp points, fitting a nut with the same dead sharp points theoretically correct? I have not, and I never heard of a call for any such thing from any one who knew what he wanted. In practice, a screw plank is turned, say for an inch bolt, .01" under size, so that the thread does not come to quite a sharp point on top; then the tool always gets dull a little, leaving a little fillet in the bottom of thread.

The nut is bored about .01" large, so that the thread is dulled, and as the points of the thread on tap soon get dulled, there is a little fillet left in the roots of the thread in the nut. When the two come together there is a little clearance at top and bottom of thread, and I claim this is right. The V thread has proven itself to be the favorite, for it has held its own from the first, and I believe is gaining ground now.

In square-threaded screws there are other reasons for having a clearance at top and bottom of thread, besides that of convenience in fitting the threads.

Square-threaded screws are often used for moving slides, as in Fig. 1. Now where the screw is snugly confined in bearings at each end, as shown, and the thread bears at top and bottom, there is no chance for the thing to work without binding, unless the work is about perfect everywhere.

There being no need of the screw fitting top and bottom, is it not foolish to make it that way? I have seen such work done often, and in every case there was more or less swearing, and finally botch work to make the thing go.

In doing such work usually, we would bore the outside bearings in line first, then, with the nut in place, and the slide at the end of its travel, bringing the box and nut in contact, we would use the bore of box for a jig to drill the nut. Now the drill will run a little, and then the taps will run a little (by ordinary methods), and if these littles happen to add together, they make quite an error. A man should not expect that such a rig could go together without any clearance and work freely.

It need not be necessary to try this to know that there will be a bind, for common sense ought to teach this. Now in the case of an inch screw, suppose we make the screw blank .005" under size, then cut bottom of thread .005" under size, and bore the nut large this amount. The screw is just as good for all practical purposes, and there is a chance for the slide to work freely with the little error that is frequently bound to appear.

In the construction of machinery, good

judgment is needed to distinguish where these clearances can be from where they cannot be.

In the case of some machine spindles we need good fits. We want the spindle to bear, if possible, clear through each box, and so we have to go to extra precaution in boring, but where this extra fineness is not needed, why try to have it, just to satisfy a foolish theory?

The matter of making proper allowances and clearances, where the work will permit, is an important part of the machinists' trade, but strange as it is, many who pretend to be machinists are always getting into trouble on account of their work not going together as it should, for the want of proper allowances to allow for the natural errors. These men do not blame themselves at all, but blame the "luck." Now there is no luck about it. If we make a thing so it can go, it will, and if it is made so it can't, it won't, and we might as well plan that way.

I knew of a case, not long ago, in a large shop, where a great many apprentices were taken to learn the machinists' trade. A boy fitted some square-threaded screws, and the boss was giving him some pretty solid advice because he did not make the threads bear top and bottom. The boy asked why the threads should bear so, and received this reply: "Why? Why, because that is right."

In putting machines together with bolts and screws, there are some parts that we want to locate fine, and take apart quite a number of times, and put together without changing the location; and then there are other parts we are not so particular about.

Now when we are particular about the location, I have found it to be best to use dowel pins, where circumstances will permit, and not depend upon the bolts or screws for anything more than for clamps.

In using bolts as clamps, there is no need of them filling their holes, and it is best not to have them that way, for they are apt to bind, and so throw out the work. Machine screws make very poor dowel pins, for the thread is apt to be eccentric with the body, consequently they will throw the work out.

I have found plenty of men who were afraid to drill tap holes more than one thread deeper than the screw is intended to go, and then break taps, and grind off screws, and swear, and wear out time and patience enough to be worthy of a better cause. But they never seem to learn any better, and the next time do the same thing. They believe this is right, and they are doing good work, for somebody told them so.

I have seen workmen shape parts of machines to dimensions within .001", where this was unnecessary; but these fellows were very careful to get off the last thousandth, for they were very much afraid it would rub off the tail of a comet, or something of that kind.

In an old-time shop where I once worked, the foreman would hardly allow a keyway in a shaft to be deep enough, for he was so much afraid of weakening the shaft.

He did not seem to think about the large allowance for safety that was supposed to be on the shaft. He would have "tight and loose pulleys" turned to same size by calipers, very close, "so that the belt would shift without stretching." In other places since, I have seen such pulleys made, one an inch larger than the other, and called an improvement. It seems to me this old foreman was rather too fine in this direction. A good illustration of a machine where the requirements have been carefully studied, and where no unnecessary work is done, is seen in a modern locomotive engine. If a locomotive was built on the purely *theoretically* correct principle, besides being a very expensive luxury, it would not run for a cent.

Which is the better mechanic—the man who studies the requirements of his work, and then makes it plenty good enough for its purpose, and stops there, or the man who aims at theoretically correct anyway, regardless of the purpose for which it is to be used?

A MECHANIC.

Boring a Circular Table.

Editor American Machinist:

In your issue of July 23d I see Charles Stetzle finds fault with the method adopted by a workman in boring out a circular table. He seems to think by using two cutters the time could be lessened one-half, and by using four cutters one-half more, or one-quarter of the time the workman took to do the job. Now he might as well put eight or sixteen cutters in the bar, and all the workman would have to do would be to set the work, start the lathe, let her spin a few minutes, then stop her and take the work off, it being already finished, without having stood two days waiting for the cutter to come round.

But he admits the work was very weak and could not be strengthened, so if he used two cutters he would have to double the feed in order to do the work in half the time, and this the work would not stand, as one cutter would be too near the skin or surface of the metal, and would have to be re-ground perhaps more than once. If he used four cutters he would still have to double the feed.

It is more than likely the workman knew what he was doing, was only responsible to his employers for the job, and should not be criticised by sight-seers. I myself bored several cast-iron pieces less than one-third of a circle, and could not use more than one tool, as the work was very weak. I also bored several pieces of cast steel 12" long, less than one-third of a circle, whose radii was only 1", $1\frac{5}{16}$" and 2" respectively, and could not use more than one cutter.

I like to give a workman credit when he is doing his best, even if it does not look very much more than to watch the bar go round.

G. S. COLLINS.

A Pittsburgh dispatch says:

At the armor-plate-mill of Carnegie, Phipps & Co., at Homestead, an armor ingot has been cast, 80 inches wide and 23 inches thick, weighing 32,000 pounds. It is the largest armor-plate ingot rolled in this country. The ingot was cast in a sand mold for a test, and the material proved much superior to that tested in a metal mold. Heretofore there has been a great deal of trouble in casting in metal molds, owing to the many flaws. An ingot cast in the sand mold was found not to contain a single flaw. It is more than likely that hereafter sand molds for turning out armor-plate ingots will be adopted. Tim McKay is the inventor of the new process He is working at the Homestead Mill.

Preparation of Blue Prints.

In a communication to the *Engineering News*, F. H. Latimer states that he has found that adding oxalic acid to the ordinary blue print mixture materially lessened the necessary time of exposure. The solutions used were: (1) Ammonio citrate of iron, 120 grains; water, one fluid ounce, to which are added a few drops of strong ammonia solution till the odor is quite perceptible. (2) Potassium ferricyanide, 105 grains; water, one fluid ounce. (3) Saturated solution of oxalic acid. Equal quantities of the first two solutions were mixed together, and to ten parts of this mixture from one to three parts of the oxalic solution are added just before use, with the result that in cloudy weather the solution containing three parts of oxalic acid prints about ten times as quickly as the pure solution. For ordinary purposes, however, it is better not to add more than 20 per cent. of the oxalic acid solution, or difficulty will be found in getting the lines to wash white.

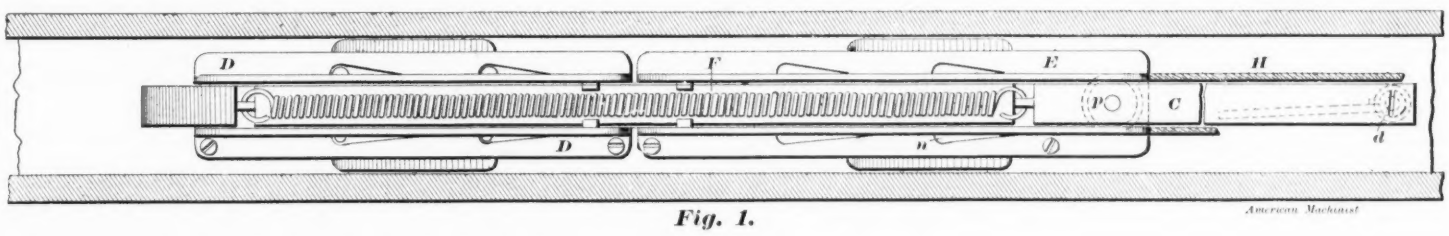


Fig. 1.

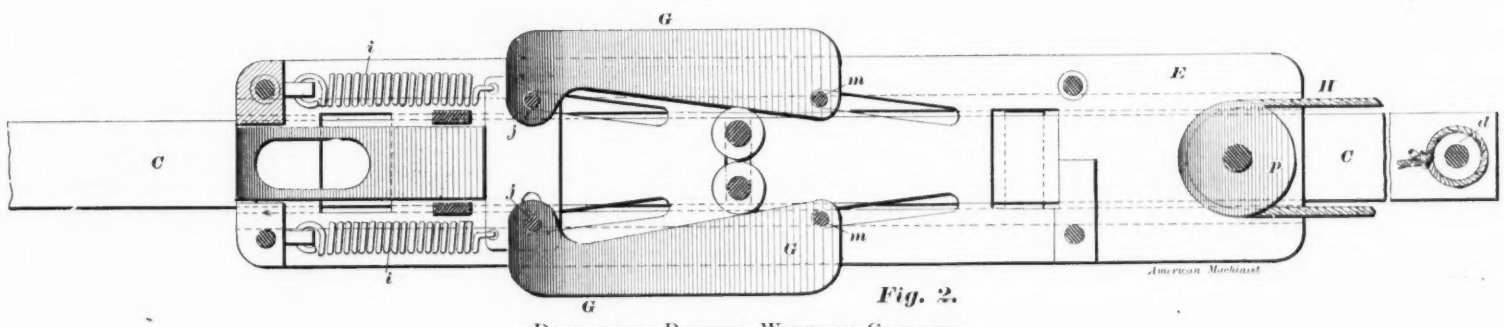


Fig. 2.

DEVICE FOR PUTTING WIRES IN CONDUITS.

Device for Putting Wires in Conduits.

In placing wires, cables, etc., in underground conduits or pipes the present method usually pursued is to use short sections of iron rod or small pipe which are screwed together as they are pushed through, until the end emerges from the length of conduit. The wire or cable is then attached, and as it is drawn through, the sections of rod are unscrewed again. This, of course, is a slow process, and moreover limits the length of conduit which can be threaded.

We present herewith engravings of a device for carrying wires or cables through such pipes, which is so constructed that it can be worked entirely from the entering end of the conduit, and is not limited as to the length of conduit that can be threaded within reasonable limits.

The apparatus consists of two small carriages joined together in the manner hereafter to be explained, and introduced into the pipe as shown by Fig. 1, which shows the conduit in longitudinal section with the device in place within it, while Fig. 2 shows the outer or right-hand carriage *E*, with its upper part removed to show the construction.

The two carriages are joined by two spiral springs, one of which is shown in Fig. 1, the other one being below and opposite to it. These springs tend constantly to draw the carriages together as here shown. Just under these springs at each side are two strips of iron *C*, which are rigidly attached to the inner carriage *D*, but slide freely through carriage *E*, and, extending back of it, are joined by a stud *d*. On a stud fixed in carriage *E* is a pulley *p*, around which is passed a rope, one end of which is attached to *d*, while the other is free, and of a length sufficient to enable it to always remain out of the conduit and be pulled by the operator. Within the carriages are gripping pieces *G*, formed as shown in Fig. 2, the springs *i* tending to pull them forward, and, by means of the inclined slots into which the pins *m* and *j* project, force them outwards against the inner sides of the conduit. Supposing the carriages to be in the position shown by Fig. 1, a pull on the rope *H* has the effect of forcing the gripping pieces *G* in carriage *E* back against the resistance of springs *i*, and outward against the sides of the conduit. This prevents carriage *E* from moving, and the continuing pull on rope *H* acting on stud *d* forces the strip *C* and carriage *D* forward against the resistance of springs *F*, which are thereby extended. This movement draws along the wire or cable which is attached to stud *d*.

Upon releasing the rope *H* the springs *F* act to draw the carriages together again, the first effect of this being to force the locking pieces in carriage *D* outwards, holding it securely, while at the same time the forward pull on carriage *E* loosens the locking pieces and allows this carriage to be drawn up to the other, when another pull on the rope produces the same effect, and the carriages are advanced another step. Thus by repeated pulls on the rope *H* the carriages advance until they come out at the other end.

Of course this may be done quite rapidly, and when a cable is too heavy to be pulled through directly a rope or wire can be attached and drawn through, by which the cable may be afterwards drawn through. The machine has been tried here in New York City, and has demonstrated its efficiency, having passed through 285 feet of conduit in 12 minutes. It has been recently patented by Mr. F. A. Wessel, of Brooklyn, and is controlled by him and Mr. August Giese, of 2 Cedar street, New York City.

Two little girls on a Cass avenue car were discussing their plans for the summer. One said, "Papa and mamma and Freddie and I are going to have the loveliest little tent on Orchard Lake, and we'll have just heaps of fun for weeks and weeks." "Oh," said the other, with a worldly and superior air, "that's so common. Mamma and her maid and nurse and baby and I are going to Bar Harbor." "But what's your papa going to do?" "Why," in a surprised tone, "he's going to stay home and earn money to send us, of course, just as he always does."—*Detroit Tribune.*

One of the gigantic "deals" of the day is the proposed rubber trust. It is expected that, with a capital of ten million dollars, it will be possible to corner the entire rubber supply of the world. When this is done, it may reasonably be expected that a strong impetus will be given to the finding of something to take the place of rubber, and in the end the trust will be cornered.

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J. G. A. MEYER, } Associates.
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A Ten-year Old Suggestion.

It is estimated that the full operation of the new United States law relating to the carrying of foreign mails will result in the building and equipment of thirty American steamships. If this expectation is realized, it will afford, for some time to come, a considerable stimulus to the machinery trades and a number of related industries, already favorably affected by the current activity in naval construction.

As we understand the provisions of the new law, to carry out which proposals are now being invited by the government, its essential feature—of course, with the prudential limitations which would naturally occur to the law-making power—is very closely in line with the following suggestion, contained in an editorial article published in the AMERICAN MACHINIST of July 31, 1880, and entitled, "The Merchant Marine Problem":

Let the National Legislature model its action after the sensible procedure frequently adopted by American towns and cities in inviting proposals for buildings or public works; which stipulates that estimates from *resident mechanics* only will be entertained, and the problem is solved so far as a great and growing steamship marine is concerned. The government is in the business of providing mail service for its citizens with all parts of the world. Let it be enacted next December that, beginning twelve months thereafter, all new contracts for carrying the United States mail to prominent foreign distributing ports, shall be awarded for the next ten years only to vessels sailing under the American flag, and American enterprise will have the vessels built in American shipyards and running within the time. It is true, the government would have to pay more than at present for carrying the mails; but the government should afford to marine interests something like the measure of protection that it accords to every other interest.

It will be seen that our suggestion antedates the action of Congress almost exactly ten years, but then Congress always was a rather slow body! Opinions will always differ, of course, as to matters of governmental policy, but it seems very clear that, our general fiscal policy being what it is, so long as other great commercial countries pay steamship lines considerable sums yearly for carrying mails to and from the foreign countries with which their people want to trade, we must take similar action if we care to trade extensively with those countries. At the worst, it would seem to be a question as to the relative advantage of getting our letters carried at a less cost, but in a very roundabout and slow way, or getting them crrried directly and quickly at such cost as the service is worth. In any event, whatever view machinery people may take as to the correctness of the principles underlying the law in question, they will not be slow, as we believe, to avail themselves of any chance of profit involved in building up an American merchant marine, or in using it for trade purposes when built.

The Richmond Chamber of Commerce.

In these times, when the prosperity of a city is so largely dependent upon the way a hundred different things are attended to, the city that has a good Chamber of Commerce is fortunate. What is every one's business is, proverbially, the business of no one, hence the utility of a body that is looking after all the minor as well as the greater interests of the city. In the matter of manufacture—which builds up a city faster than any other single interest—a live Chamber of Commerce can do many things that help along.

We have recently received from the Chamber of Commerce, of the city of Richmond, Va., its annual report, and after reading it are more than ever impressed with the importance of the work that such a body can accomplish. This Chamber seems to have taken right hold of about everything—those things that, taken as a whole, make of a city a desirable place for the capitalist and the workingman.

For example, the report calls attention to the lack of suitable houses for mechanics; houses at reasonable rent. This is in the line of wisdom. Mechanics will gravitate to places where they can find comfortable houses at such rent as they can pay, and shun those places where the conditions are contrary.

Then the report deals with the matter of better mail and passenger facilities, sites for manufactories, insurance rates, and various subjects, in every one of which manufacturers are interested.

There is no intention on our part to especially praise the work done by the Richmond Chamber of Commerce. Our only desire in the matter is to call attention to the fact that it is a live body, and likely to keep that city well before the country in such a way as will attract mechanics and capitalists, not by fulsome praise, but by honest and hard work in the direction of making things better, and taking advantage of natural conditions. Other cities that recognize the importance of manufacture and trade may profitably study the report of the Richmond Chamber of Commerce.

Machinery will Go In Free of Duty.

By the terms of the recently published reciprocity treaties American machinery is to go into the islands of Cuba and San Domingo free of duty, while important advantages are also secured for many other American products. We are not informed as to the rate of duty heretofore charged upon American machinery entering those islands, but the concession is doubtless of sufficient value to warrant American manufacturers in taking advantage of it, especially in the case of so large and populous a country as Cuba. Neither country is ever likely to do very much manufacturing on its own account, so whatever trade is gained this way can, in all likelihood, be held.

The matter-of-fact way in which those interested in the hard coal trade discuss plans for restricting the mining operations, and thereby maintaining prices at a figure satisfactory to themselves, is quite instructive to those who for domestic or manufacturing purposes have the prices to pay for coal. To such consumers it seems as though these prices are sufficiently high, but we notice that a correspondent of the *Coal Trade Journal*, who seems to know just what he is saying, finds considerable fault with dealers and miners, because they cannot be induced to strictly observe their obligation to "the trade" regarding the restriction of production. He says there is altogether too little regard for solemn promises made in this matter, and that the amount of coal agreed upon as being likely to bring the best returns to "the trade" is regularly exceeded by the greed of individual members of the combination, and the matter is discussed as though the highest moral principles were involved in the observance of the agreement by which prices are kept up, and there was absolutely nothing to be said on the other side, and for manufacturing interests, poor families, or miners thrown out of work by restriction of production.

A great many cities in this country are working to the end of locating manufactories. This is in every sense a laudable thing to do. Manufactories make a city prosperous. They bring trade to local dealers, provide for the rent of houses, and, in a word, generally distribute money. These efforts very generally take the direction of providing easy terms for manufacturers, and this very properly. But aside from this there is another feature of the case. Manufacture in those branches where skilled labor is required must have the means of attracting and holding that labor. A man who works for wages does not expect to get rich, but he does expect to find a pleasant place in which to live, and the comforts of life within his reach. When things are different from this the manufacturer is handicapped; he must get along with indifferent workmen, or pay higher wages.

At the Omaha and Grant Smelting Works the men have been required to work from eleven to thirteen hours per day. But recently an eight-hour law has gone into effect in the State. As might have been expected, the company objected to the short hours, and required the men to sign contracts that would nullify the law. And, as might similarly have been expected, the men proposed to take advantage of what they considered favorable legislation. The result has been the stopping of work. The workmen are not Americans.

Considerable surprise is expressed by the daily press that railroad stocks show a decline in the price at which they will sell. Suppose the stock of our great manufacturing concerns was watered about three to one, with unlimited opportunity for further dilution, would it be any wonder that prices of the stock declined?

The total number of immigrants landed in this country for the year ending June 30, was 555,496, a gain of 23 per cent., as compared with the previous year. There has been a decrease in the number of immigrants who speak English.

Literary Notes.

CAR LUBRICATION. By W. E. Hall, B. S., M. E.

This little book of 66 pages will undoubtedly be read with great interest and profit by many who have under their care the lubrication and construction of railroad car, and other kinds of journals. It contains only a few mathematical formulas, and to two of these, calculus has been applied. But these need not deter practical men from a careful perusal of the book, as it contains much information of a practical character. It is published by John Wiley & Sons, 53 East Tenth street, New York. Price $1.

SCREWS AND SCREW-CUTTING MACHINES, with a chapter on the Milling Machine, a complete Treatise on Screw Making in all its Branches, embracing most recent Methods, and containing the Reports which originated Modern Standard Screw Threads. With 95 Illustrations. Edited and published by the Britannia Company, Makers of Engineers' Tools, Colchester, England.

The greater part of this book is devoted entirely to screws and screw making. The treatment of this subject is very exhaustive and thorough, and is presented in an easy manner, intended to interest, and be of value to practical men. Much of the information has been gathered from the transactions, etc., of several learned societies, and other papers which are often inaccessible to the mechanic. The reports by the several committees, appointed by powerful organizations, for the purpose of investigating the whole system of screws, their thread-forms, pitches and diameters, are given unabridged, and without comment. It also gives the paper by Whitworth, in which the principles that govern the dimensions of the now universally recognized Whitworth screws are set forth. This paper is followed by the considerations which led, at a later date, to the adoption of Sellers system. The Swiss system refers to screws under ¼ inch diameter, and which are not included by the Whitworth nor the Sellers system. The book also treats on chasing screws by hand; screw plates; dies and taps; cutting screws on the lathe; arithmetic and rules for calculating wheels; screw or spiral, and worm wheels; machines for screw making; and the milling machine; the illustrations of the latter represent those made by the Britannia Company. A table, of considerable extent, of wheel trains to cut various thread-rates by the aid of guide screws; and several other tables of screws and nuts are valuable. These subjects, with a complete index, take up 208 pages of the book. Pages 209 up to 312 form a catalogue of the tools built by the Britannia Company. The information given in the reading matter is well worth the price, $1.25. The book may be obtained from E. & F. N. Spon, 12 Cortlandt street, N. Y.

In a recent issue we noticed the book, "Construction and Use of Universal and Plain Milling Machines," published by the Brown & Sharpe Manufacturing Company, Providence, R. I. In that notice we referred

to the book as being in paper cover. Since then we have received a copy of the book bound in cloth. This, of course, makes it much more durable, and better calculated to serve the purposes of those who want it for a book of reference.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(355) G. H. R., ——, asks: Will you kindly inform me if stationary engineers running engines in New York City are required to have licenses? *A.*—They are.

(356) M. C. C., Chicago, Ill., asks: Will you please inform us by whom and where Mitis castings are made? *A.*—By the Wrought-iron Casting Company, Boston, Mass.

(357) E. B., Columbus, Ohio, asks: Will you please give a simple rule for finding the area of a cylinder? *A.*—Any arithmetic will give you the simplest rule there is for this, and the mechanics' pocket-books are replete with tables from which you can get the areas without computations.

(358) L. C. B., ——, writes: Please tell me how to get the correct lay-out of the bolt holes for the flange of a governor, which are irregularly placed, without removing the governor. *A.*—We know of no way of doing this in a satisfactory manner, and think the better plan would be to remove the governor.

(359) S. P. D., New Orleans, writes: Please inform me what process is used to harden emery powder on a surface, and whether good marine glue would answer where it is to be subjected to a light heat? *A.*—Glue is usually employed to fasten emery to surfaces of leather or wood, and will answer where the heat is not great.

(360) W. M., Worcester, Mass., asks: 1. What kind of a file (the cut, I mean) should be used on brass to do the most effective work? *A.*—It depends upon what you want to do, and may be anything from rough cut to dead smooth. 2. What is the fluid machinists use when laying out work, so they can see their lines? *A.*—Bluestone dissolved in water.

(361) S. T. W., Mound City, Ill., writes: I have a number of lathe mandrels (steel) that I made myself, and would like to hear from your readers as to the best method of case-hardening them without springing out of true. *A.*—Some of our readers may know of a way of doing this, but we very much doubt it. Lathe mandrels should be ground true after hardening.

(362) E. U. S., Sedalia, Mo., writes: I have an emery wheel which is 4x2 inches. How may I divide it to make two wheels one inch wide? *A.*—We do not know of any way of doing this. If the wheel is soft it may be cut in two in the lathe by a parting tool, the same as if it were of iron, but the thickness of the wheels will then be less than one inch by half the thickness of the tool.

(363) S. T. W., Mound City, Ill., writes: Will you please give me a method of annealing cast-steel so that it can be worked easily in lathe or by drill? Have tried lime, sawdust, ashes and soap suds, but none of them are satisfactory. *A.*—We do not know how soft the steel would need to be to satisfy you, but if steel is heated uniformly and carefully to a low red heat and put into air-slacked lime or ashes until cool, it will be about as soft as it can be made.

(364) F. P., Mankato, Minn., asks: Can you give me a receipt for tempering tools for corrugating chilled flour-mill rolls? Have got one but it don't seem to stand very well. *A.*—Our receipt would be as follows: 1. Tell a reliable steel-making firm just what you want to do with the steel, and ask him to furnish steel adapted to that purpose, and to give you directions for tempering that particular steel. 2. Follow the directions as closely as possible.

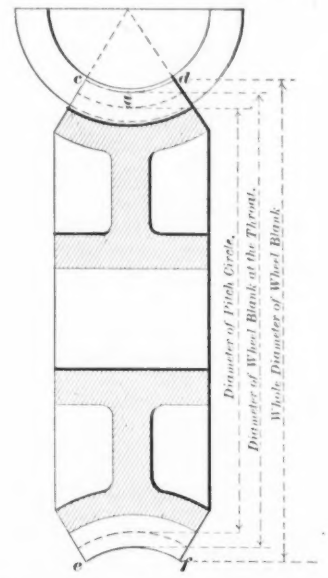
(365) G. W. S., St. Louis, Mo., writes: I have several hundred pieces of thin sheet steel—about $\frac{1}{16}$x1x6 inches, which I wish to plate by dipping. Kindly inform me if there is any metal or alloy which I can melt in a pot, and that will firmly adhere to the steel—mild steel—by dipping, and which will not stain or color when brought in contact with fruits, vegetables and perspiration, or with vinegar. The plating should be white. *A.*—We know of nothing that will entirely fill the conditions. Tin will come as near doing it as any of the common metals.

(366) K., New York City, sends us our answer to Question 204, in which we stated that gas or air cannot be used with advantage in an ordinary engine. Air or gas motors require a construction different from that of an ordinary engine. Our correspondent asks: Why? What different construction? I have seen a steam engine worked by compressed air, and it seemed to work all right. *A.*—We are aware that ordinary engines have been and are run by compressed air, and under certain conditions will do all that is required of them. But we believe it is safe to say that, when an engineer is asked to select an air motor, which is to be successfully used day in and day out, he will not select an ordinary steam engine. Although the main construction of the two does not differ in principle, yet they do differ in the designs of their details. See answer to Question 333 in our issue of July 23.

(367) W. J. H., Ithaca, N. Y., writes: In the shop where I served my time there was a lathe built by Bement & Dougherty, of Philadelphia. The index plate called for 96 on the spindle and 16 on the lead screw to cut a thread of 1½-inch pitch. There was a change pin, and pulling this out the same gears would cut ¾-inch pitch. The lead screw was four threads per inch. I have looked all the books I have through for a rule for these gears but cannot find one. Will you please give one? *A.*—We are unacquainted with the details of construction of the lathe you refer to, but it is evident from your statement that the regular rules apply to it the same as to other lathes. The gears 96 and 16 are in the proportion of 6 to 1, and the pitch of 1½ inches is in the same proportion to the pitch of the lead screw, which is ¼ inch. This shows that with gears of equal size on the stud and lead screw the lathe would cut a screw equal in pitch to its own lead screw with the pin pushed in, and twice its pitch with the pin pulled out. When the pin is pulled out the screw may be considered to be two threads per inch instead of four, and then the ordinary rules apply, the gears being in the same proportion to each other as the screw to be cut and the lead screw.

(368) J. C., ——, asks: Will you kindly give me the names of some of the technical schools of this country, and would you advise me to enter one of them? I am 21 years old, and will finish a three-years apprenticeship in a machine tool establishment in November. I am not very strong in mathematics, and have some doubts as to whether I would make a success of it if I took a course in one of these schools. I like the manual part of the business (machinists') first-rate, and would like to know something of the technical part of it. *A.*—If you desire to possess a thorough technical education you cannot do better than to take a course in a school where mechanical engineering is taught, provided that you regard this course simply as an assistance to you in acquiring the training and knowledge you wish eventually to possess, not as an end of itself. Very many are benefited by such a course, while there are others who do as well without it. It depends to a large extent upon personal qualifications. Some of the leading schools at which mechanical engineering is taught are as follows: Cornell University, Ithaca, N. Y.; Lehigh University, Bethlehem, Pa.; Massachusetts Institute of Technology, Boston, Mass.; Ohio University, Columbus, Ohio; Stevens Institute of Technology, Hoboken, N. J.; Troy Polytechnic Institute, Troy, N. Y.; University of Illinois, Champaign, Ill.; University of Virginia, Charlottesville, Va.; University of Wisconsin, Madison, Wis.; Worcester Polytechnic Institute, Worcester, Mass.

(369) G. N., ——, writes: I would like to know if there is any given rule to find how much vibration to allow in fitting wheels on shafts, as for instance: Suppose I was boring a pulley to fit a six-inch turned shaft, how much should I allow the calibers to vibrate? In my home in Wales I never heard of vibration, but worked one caliper to another by guess, and as I lost a job one time because I could not answer the foreman's question in regard to this matter, I hope you will let me know something about it through your paper. *A.*—If the foreman had no other reason for discharging you he has, in our opinion, missed his vocation, and should "go into the post-hole business as being less abstruse." It is perfectly well understood among men who know anything of calipering, worth talking about, that no two men caliper just alike when using ordinary spring or hinged calipers. Some allow a certain amount of what you call vibration in calipering a hole, *i. e.*, they set the calipers slightly under size so that they will not touch except when swung to one side a little. But there is no rule for this, and never can be, for it depends entirely upon the individual's method of calipering. Some allow no vibration whatever, and make just as good fits as others, and are just as reliable in making them. A foreman who understands his business knows that it is no part of his business to require men to caliper in any certain way or in accordance with anybody's rules; if proper fits are secured that is as far as he need concern himself.



(370) J. B. C., Middletown, Pa., writes: Please give a rule for finding the number of teeth to put in a worm wheel so that the teeth will be parallel at the throat or circle of the throat of the worm. Take, for example, a worm 2½ inches diameter with four threads per inch; the worm wheel can be made about five inches diameter. Now the question which sticks me just here is this: By what rule can I find the correct diameter of the blank for a worm wheel which is to have 68, 70 or 72 teeth? *A.*—Your question is somewhat confusing, you ask for one rule in the beginning, and for another rule at the end. We understand you to ask for rule to compute the diameter of a blank for a worm wheel as shown in the figure, the circular pitch and the number of teeth being given. Let us assume that 70 teeth are required, and that the worm has four threads per inch. The circular pitch will be ¼ or .25 of an inch. Our first step will be to find the diameter pitch; this is found by multiplying the circular pitch by the constant .3183; hence the diameter pitch in this case will be $.25 \times .3183 = .079$. We can now find the diameter of the pitch circle, which is equal to the product of the number of teeth into the diameter pitch, hence we have $70 \times .079 = 5.53$ inches for the diameter of the pitch circle. Most mechanics make the addendum of the teeth, that is, the distance *a* in the figure, equal to one pitch diameter; this proportion will make the diameter of the wheel blank at the throat equal to the product of the number of teeth plus 2 into the pitch diameter, hence the diameter of the wheel blank at the throat will be equal to $(70 + 2) \times .079 = 5.68$ inches. Now, having computed this last diameter, the arcs *c d* and *e f* must be drawn full size, and then the whole diameter of the wheel blank is found by measurement. When the wheel is to have less than 32 teeth the above rule will not hold true, as the addendum of the teeth will be greater than here given.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

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Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 170 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Adjustable Shrinkage Gauges. Pedrick & Ayer, Philadelphia, Pa.

Link Milling and Slotting Machine. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

Headquarters for Star Hack Saws, Miller's Falls Co., 93 Reade Street, New York.

S. A. Smith, 23 So. Canal St., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

Engines and mach'y, all kinds, new and second-hand. Audubon Machine W'ks, New Haven, Conn.

Boston Gear Works, Boston, Mass. Gear cutting of every description; noiseless gears a specialty.

Inducements are offered by M. L. Funkhouser, of Carlisle, Pa., to mfrs. to locate there. Write him.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

Hyd. press, hyd. jacks, steam tables, accumulators, cutting and stamping dies for sheet metal, foot press, etc. S. Hartley, 245 N.J.R.R.Ave., Newark, N.J.

Self-adjusting Hand-Screw for Pattern and Cabinet Makers, Wood Workers, etc. Sample by mail for 50 cents. Wm. H. Denney, Lancaster, Pa.

Upright Drills and Iron Planers, for immediate delivery; prices reasonable. J. E. Snyder, Worcester, Mass.

Send $1 for "Arithmetic of Electricity," by Sloan. The only complete book ever published on the subject. Norman W. Henley & Co., 150 Nassau St., N. Y.

Hawkins' Maxims and Instructions for the Boiler-room, No. 5, just out, 25 cts.; in all, 10 parts. Theo. Audel & Co., publishers, 91 Liberty Street, New York. Catalogue.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

DuBois & DuBois, Patent Attys., 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo., cloth, $3. Catalogue of books on mech. subjects free. E & F. N. Spon, 12 Cortlandt St., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

The Richlands, Va., Rolling-mill doubled its capacity recently.

A. L. Dorris, of Ohio, will establish a knitting-mill at Attalla, Ala.

The Russellville, Ky., iron foundry will be put in operation at an early date.

The Winsted Edge Tool Company, Winsted, Conn., is to add new machinery.

The electric light plant of Lancaster, O., will be greatly improved and enlarged.

Ulrich Eberhardt is building a one-story brick foundry, 83x50 feet, at Newark, N. J.

The nail-mill of Kelly & Co., of Ironton, Ohio, will start up about the first of August.

The Brooklyn Railway Supply Company, Mianus Conn., is to erect a new factory building.

The Board of Trade is endeavoring to secure the location of railroad machine shops at Dallas, Tex.

A fertilizer factory, with a capital stock of $40,000, is reported as to be erected at Dublin, Ga.

A large extension will be built next year to the plant of the Monadnock cotton-mills, at Claremont, N. H.

Flegle's Pipe Covering Company, St. Louis, Mo., has been incorporated, with a paid-up capital of $100,000.

Leonard & Cornell, boiler makers, of Jackson, Mich., contemplate removing their works to Elkhart, Ind.

The American Bolt and Rivet Company has been incorporated at New York, with a capital of $1,040,000.

The Rome Cotton Tie and Manufacturing Company, Rome, Ga., will double the capacity of its rolling-mill.

The Tampa, Fla., Illuminating Company will, it is reported, change its incandescent plant to an arc light system.

The Juniata Furnace and Foundry Company, of Philadelphia, has been incorporated, with a capita stock of $200,000.

The citizens of Tifton, Ga., are investigating the cost of laundry machinery, with the view of establishing a laundry.

The Forth Worth (Texas) Iron Works is reported as to add the manufacture of a new patent ice machine to its plant.

It is reported that brick works, capitalized at $100,000, will be established at Fort Worth, Texas, by Boston parties.

The Board of Trade at Rome, Ga., is negotiating with out-of-town parties for the establishment of a $500,000 cotton-mill.

The Lorain Steel Company has been organized at Kittory, Me., to manufacture iron and steel from pig to structural forms.

J. S. Smith and associates have organized a stock company, with $50,000 capital, to establish brick works at Jacksonville, Fla.

The Alpine Knitting Company, Pittston, Pa., will build a new factory 100x100 feet, three stories, to double its present capacity.

Efforts are being made to establish a woolen-mill at Stockton, Ill., with a capital of $20,000, half of which has been subscribed.

The commissioners of Collad County have authorized the construction of a bridge over the San Antonio River at Charco, Tex.

The O. S. Wilt machine shops, at Tennille, Ga., will be put in operation under the management of B. B. Farris, of Rocky Ford.

The rolling-mill at Fort Worth, Texas, will, it is expected, be in operation in September, giving employment to about 150 men.

Active operations have begun on the foundation of the new woolen-mill at Newport, Me., and will be pushed as fast as practicable.

The Russell & Irwen Co., of New Britain, Conn., are building a new brass foundry and making other extensive additions to their works.

The Southern Engine and Boiler Works Company, located at Jackson, Tenn., has let contract for the erection of a boilerhouse 65x100 feet.

There is talk of a new iron foundry at Henderson, Me., to make castings required for locomotives and cars on the Canadian Pacific Railroad.

It is stated that a $200,000 iron furnace will be erected at Mountain City, Tenn. B. L. Dulaney, of Bristol, can probably give information.

A $50,000 stock company may be organized at Spartanburg, S. C., to manufacture a ditching machine invented by C. F. Christopher.

The Macon City and Suburban Street Railway Company, Macon, Ga., is reported as to erect an electric power plant at a cost of $35,000.

Endeavors are being made to organize a stock company to erect a cotton-mill in Clinton, N. C. M Butler can probably give information.

A stock company has, it is stated, been organized for the purpose of erecting an iron foundry and machine shops at South Pittsburg, Tenn.

M. F. Morris, Semmes Kell and others, are reported as to establish an iron foundry, machine shop, carriage and wagon factory at Griffin, Ga.

Pueblo, Col., expects to secure the location of the Pullman Steel Car Works. This will be a gigantic industry employing a force of 1,200 men.

Fort Worth capitalists and others have, it is stated, incorporated a stock company for the purpose of erecting an electric light plant at Quanah, Tex.

The muck-bar and plate-mills of the Roanoke (Va.) Iron Company are about completed. The former will be 332x76 feet in size, and the latter 304x84 feet.

It is stated that Pittsburgh, Pa., parties are endeavoring to organize a $200,000 stock company for the purpose of erecting a steel plant at Jasper, Tenn.

M. L. Gardner, of Nashville, is in correspondence with the Chamber of Commerce relative to the establishment of an industrial plant in Knoxville, Tenn.

It is reported that William Peter will build another woolen mill at Columbiaville, Mich., in order to use the coarse wools grown in that part of the State.

The Linwood Iron Works Company, Linwood, Pa., will shortly build a new machine shop and foundry of double the capacity of the present plant.

J. B. Crossland, of Pensacola, is investigating with a view of organizing a stock company for the purpose of erecting an electric light plant in Milton, Fla.

The Chesapeake & Ohio Railroad Co.'s blacksmith shop at Clifton Forge, Va., recently burned, will be rebuilt by the Chesapeake & Ohio Development Co.

Woodward & Rogers, machine tool makers, of Hartford, Conn., have recently added to their machine shops, and have increased them to double capacity.

The West Virginia Building Company has been incorporated at Ronceverte, W. Va., to operate iron foundries, machine shops, etc., and to lay out a new town.

The Marshall Furnace Company, Newport, Ky., is reported as to erect a foundry to cast iron articles from the molten metal direct from the furnace cupola.

The Falcon Iron and Nail Company, of Niles, O., intends to engage in the manufacture of tin and terne plate, and will increase its facilities for making block sheets.

The Hinckley & Egery Iron Company, of Bangor, Me., have put in operation the plant of the Penobscot Steam Boiler Company, which recently settled up in insolvency.

It is reported that the Hanover Machine Works has been organized at Frederick, Md, with a capital stock of $100,000, for the purpose of manufacturing machinery.

The Steel Barbed Fence Ribbon Company, capitalized at $250,000, has been organized and incorporated, and will establish a barbed wire factory at Valverde, Col.

The stockholders of the Scottdale Iron and Steel Company, of Scottdale, Pa, have elected P. S. Loucks, president, J. B. Stauffer, treasurer, and Clark Grazier, secretary.

The Taylor Iron Works, at High Bridge, N. J., it is said, are about to resume business on a larger scale than ever. The works have for a long time been running on half time.

A $50,000 stock company has been incorporated, with J. N. Brown, president, and J. R. Vandiver, treasurer, for the purpose of establishing a knitting-mill at Anderson, S. C.

The Roanoke, Va., Milling Company is putting in machinery to double its capacity. The mill is owned by J. L. Gambrill, and was built about three years ago at a cost of $80,000.

A new company, of which J. B. Wattles, of Suncook, N. H., is manager, proposes to build a plant in Penacook, N. H., to manufacture yarns and twines, with a capital of $50,000.

The Fort Worth and Denver City Railway Company (office, Fort Worth) has, it is reported, made a proposal to remove its Clarendon machine shops and roundhouse to Childress, Tex.

The Kennedy Valve Manufacturing Company, capitalized at $150,000, has been incorporated at Albany, N. Y., to manufacture valves and hydrants, special and all kinds of machinery.

The West Michigan Car and Machine Company is the corporate name of the reorganized Muskegon Car Company, of Muskegon, Mich. The new company has a capital stock of $250,000.

The Springfield Iron Company, Springfield, Ill., have determined to, at once, rebuild their plate-mill on a larger scale. As will be remembered, it was destroyed by fire a week or so ago.

The United States Rolling Stock Company, at Anniston, Ala., intend to construct a new mill for merchant bar iron. They now have fourteen puddling and heating furnaces in operation.

A company has been formed at Kittanning, Pa., with a capital of $100,000, for the purpose of manufacturing the recently patented Dougherty typewriter. The plant will be erected there.

The present firm known as the Schoen Manufacturing Company, of Allegheny, Pa., will be succeeded by the Schoen Pressed Steel Brake Beam Company. Application has been made for a charter.

The works of the Chicago Axe Company, at Hammond, Ind., have been bought by Peoria (Ill.) capitalists. The purchasers, it is said, will spend $100,000 in enlarging the plant, and employ 600 men.

The Ross-Mehan Brake Shoe Foundry Company has purchased the machinery of the Globe Iron Works, at Sheffield, Ala., and removed same to its foundry and machine shops at Chattanooga, Tenn.

The cotton-mill company at Des Moines, Ia., has been reorganized as the Mason-Ross Cotton Company, which will operate the plant after new machinery has been added. New capital will be put into the business.

J. F. Dickinson, W. H. Rhett, W. H. Inman and others, have incorporated the Edison Electric Illuminating Company for the purpose of erecting an electric light plant, etc., at Atlanta, Ga. The capital stock is $10,000.

According to *Power*, there are in operation at the Washburn & Moen Company, at Quinsigamond, Mass., 45 engines, comprising 59 separate cylinders, and aggregating 6,000 horse power. This does not include steam hammers and a large number of steam pumps.

The Norwood Car Replacer Company, of Baltimore, Md., recently mentioned as to establish car replacer works in Norfolk, Va., has, at a recent meeting of stockholders, authorized the issuance of $100,000 of additional stock to secure funds for erecting its plant.

The Cannonsburgh Iron and Steel Company, of Pittsburgh, is making extensive improvements and additions to its plant at Cannonsburg, Pa. The company has placed an order with the Leechburg Foundry and Machine Company, of Pittsburgh, for a 22-inch sheet-mill.

There is water-works agitation in Everett, Pa; Northumberland, Pa.; West Union, Iowa; Attleboro, Mass; Hannibal, Mo.; Mansfield, Pa.; Chicopee, Mass.; Marcellus, Mich.; Gilroy, Cal.; Nappanee, Ind.; Lowville, N. Y.; Holyoke, Mass.; Brunswick, Md.; Belton, Texas; Washington, Iowa.

The syndicate that recently bought the Whitely Reaper Works in Springfield, O., will be known as the Central Car and Repair Manufacturing Company, and will have a capital of $500,000. The works will be started up in sixty days with a large force of hands, and will be the largest car works in the United States.

Inducements have been offered G. E. Sharp to move the large foundry of which he is the head, from Steubenville to Youngstown, Ohio. It is said the proposition made to the foundry amounts to $25,000 cash. A proposition is under consideration by Steubenville citizens, who desire that the foundry remain there.

The Thomson Meter Company, Nassau and Beekman streets, New York, has recently made a new dial for their water meters. This dial is read more directly than the old one, and they have submitted it to the opinions of experts on the subject, whose opinions are published in a little pamphlet issued by the company.

On August 11 next, John S. Cleland, W. J. Kiskaddin and others, of Pittsburgh, will make application for a charter for an intended corporation, to be known as the National Separating and Manufacturing Company, of Pittsburgh, the character and object of which is the manufacture of iron and steel and other metals.

The Excelsior Machine and Cleveland Punch Company, Cleveland, Ohio, has issued a new catalogue, which is very finely printed and illustrated It contains cuts and descriptions of a large number of shears, punches, drills, transfer tables and other machinery in common use, and is of interest to manufacturers and mechanics.

Eben Smith, 182 Lincoln street, Boston, Mass., has brought out one of the best eye shields we have ever seen. The "glasses" are of mica, and the general arrangement is such that they are easily applied, and entirely comfortable in use. Grinders, polishers, brass turners and many others could use these shields to advantage.

M. B. Schenck & Co., who recently purchased the old Beecher plant in Meriden, Conn., are to put the property in thorough order for carrying on their caster manufacturing business. A new 50 horse-power engine will be bought, and other new machinery purchased. When completed, the factory will employ about double their present number of hands.

B. C. Mudge & Co., of Boston, Mass., have purchased 1,669 acres of phosphate land near Tallahassee, Fla., for about $300,000; they will organize the La Pierre Phosphate & Manufacturing Company, with a capital of $1,500,000, to develop the land and erect phosphate works. The main office will be in State St. Exchange, Boston, Mass, with branches in New York and Tallahassee.

An iron plant will be erected on the site of the old Union Iron Works, at Buffalo, N. Y. A blast furnace will be erected, which will have a capacity of 250 tons per day, and is expected to be in operation in about ten months. The Columbus Bridge Company, of Columbus, O., the Lehigh Valley Shops, of Buffalo, and the Buffalo Steam Forge Company, have taken stock in this new concern.

An Angelica, N. Y., correspondent writes us: A water well has been drilled to the depth of 110 feet on Central Main street, that flows 720 barrels per day, and there is a large flow of gas. The citizens are thinking of putting in a system of waterworks, consisting of a large reservoir, a pumping engine, and make it a gravity system. The village president will receive suggestions in regard to the matter.

F. E. Mole, of Adams, Mass., is circulating a paper to raise funds with which to build a shop, boiler-house, etc., for the Linneth Manufacturing Company, of Newark, N. J., which has signified its intention of moving to town if the town will build a shop, etc., the company to have the use of it five years free of charge, and at the end of that time have the privilege of buying the plant or renting it at 7 per cent. on the cost.

The American Watch Tool Co., Waltham, Mass., having had long experience in laying out the "depthing" of watches and clocks, and developing the proper form of teeth for wheels and pinions, have now added to their business the making (to special order) of wheel and pinion cutters of either epicycloidal or involute forms, and will also cut wheels and pinions of small sizes from watch work up to that of ordinary clock work, thus giving an opportunity to obtain accurate working wheels and pinions down to the finest watch work.

A Duluth, Minn., dispatch says: The reported consolidation of the Chicago and Minnesota Ore Company with the Minnesota Iron Company, which owns the Tower Mines and Duluth and Iron Range Railway, turns out to be a much larger deal than at first reported. The Chicago and Minnesota Ore Company and the Chandler, Chippewa, Norma, Delaware and Canton Iron Companies, as well as the Duluth and Iron Range Railway and the Minnesota Steamship Company, are all owned in great part by the stockholders of the Minnesota Iron Company. It is proposed to consolidate all these into one company, which will own every mine at present shipping ore, the Duluth and Iron Range road and a total landholding of about 40,000 acres. The combined capital will be about $17,000,000. The Chicago and Minnesota Company owns 27,300 acres of mineral land on the Vermillion Range and controls the stock of the Chandler Iron Company, which made $500,000 last year. The new deal turns the Chicago and Minnesota Company at about $90 a share. The Minnesota Iron Company alone has nearly 100 acres of good iron-bearing lands in Township No. 62, Range No. 14, and is contesting directly or indirectly several claims that will no doubt be valuable. But much of its lands are like hundreds of other claims, untested, and therefore doubtful.

He Had a Scheme to Stop the Cars at His Door.

"Tickets, please," said the conductor of a train on a line running east out of Detroit, as he entered the car.

There was a very general response in the shape of pasteboard, until he came to a farmer who was very earnestly looking out of the window.

"Tickets, please," said the conductor.

The man paid no attention.

"I'll take your ticket, if you please."

The man looked up at him. "Hain't got any," he answered slowly.

"Well, the money then. Where are you going?"

"Hain't got any money."

"Well, then, what are you on here for? If I don't get either money or ticket I must put you off the train."

"You wouldn't stop an express train just to put one man off, now, would you?"

"Wouldn't I? You'll soon see whether I will or not. Now I want your ticket or the cash without any more fuss."

"Nary one."

The conductor paused for a moment or two and then called the brakeman.

"Now are you going to get off without a fuss, or will we have to throw you off?"

The man sighed and said he would go off quietly. When they got out on the platform, and the conductor had his hand on the bell-rope, the passenger cast his eye over the flying landscape and said:

"Ain't there no way we can fix this up?"

"Certainly. Ticket or money."

After another look the man shook his head. "Let her go, captain."

The conductor pulled the rope. The air-brakes scrunched and the train came to a stop. The man stepped off, and then handing the conductor a bit of pasteboard said:

"I don't cheat no railway company, captain. Here ye are."

"Why in thunder didn't you give me this before? You can ride five miles further on this ticket. Step aboard lively, now."

"Never mind, captain. I would have to walk five miles back if I did. I live over yonder. So long, cap."—*Detroit Free Press.*

What the Man from Tennessee Said.

"Ten years ago," said a Tennessee machinist, "I had a little machine shop, with four journeymen, and 'Sim' for an apprentice. In the spring rains I took a severe cold, and didn't go out of the house for four months. I worried a good deal, for I expected my little struggling business would go to the wall soon, but most of the time I was too sick to think much of the matter. Finally, when I got so as to get out, I wandered down to the shop. Instead of four journeymen I found nine, and Sim was busy in the little 7x9 office closing a contract with a rich inventor to build a steam road wagon.

"It seemed," said this machinist, "that during my sickness Sim had been in consultation with my wife, and that she, with a woman's intuition, had let him go ahead about as he pleased, and his way—with only his three years' experience—had been a better way than mine. He always had money to pay off Saturday night, and there was a little standing to my credit.

"The old shop had a brighter look than ever before. The windows were clean, and some tons of old junk had gone to my neighbor's foundry in payment for good castings. Sim had ordered a new lathe, fixed up the old engine, lined up the line shaft, and had the floor swept out and the walls whitewashed.

"Sim and I," concluded the narrator, "are partners now, and the only thing I really miss is the little old shop that he made look homelike."

Figures given by the recently issued *Bulletin* of the American Iron and Steel Association show that the production of pig-iron in the United States during the first half of this year was 8,371,925 gross tons, a decrease of

1,188,588 tons as compared with the corresponding period of last year. Some few of the States increased their production, bu the principal pig-iron producing States fel off, the total decline being about 26 per cent

The Ordnance and Fortification Board seem to be having rather serious difficulty in dealing with the bids for heavy guns. As usual, there is a certain amount of ambiguity in the Appropriation act, and it appears that this has resulted in the bids for a certain number of guns, ranging from about three and one-half million to five million dollars. This is a rather wide range for work, the cost of which ought to be susceptible of very close calculation.

The International Geological Congress, which meets in Washington the last of this month, proposes to wind up with an excursion of more than 6,000 miles. A great many notable places in this country will be visited.

Single-belt Reversing Countershaft.

In our issue of July 30, and under the above title, we illustrated an invention of C. W. Tirrell, of Bristol, R. I. In our description we referred to the possibility of spur gearing giving better satisfaction than the bevel gears shown. Regarding this, Mr. Tirrell writes us as follows:

Perhaps you will pardon me saying that I do not see the advisability of changing the gearing, as the subject of spur gears and internal gears has been carefully considered, and with spur gears you would have to use five, and would be complicated and noisy. The present form is patented, but the claims are broad enough to allow me to use the sleeve with any other gears, if required.

[Upon further examination of the arrangement of the gears upon Mr. Tirrell's countershaft, we find that the intermediate bevel gear is probably placed upon a stud, which is not at right angles to the countershaft, but at such an angle as to make it engage properly with the other gears of differing diameters. There was nothing to show this very clearly, however, and in the absence of a statement from Mr. Tirrell regarding that point, we feared that there was an arrangement of the gearing which would not work very well. With the arrangement which it now seems probable to us has been made, we see no reason why they should not work satisfactorily, though it does not seem to us to be unlikely that the five spur gears necessary to accomplish the same result would in the end be more satisfactory than the three bevel gears arranged as shown.—ED.]

Bidders on Cruiser No. 13.

The contract for cruiser No. 13 has been finally awarded to the Cramps, Secretary Tracy giving as his reasons for his decision that the Bath Iron Works could not complete the vessel within the time required; could not within the specified three months from the signing of the contract supply themselves with the necessary plant for building the entire vessel; could not in any event themselves build the engines, but proposed to have them built in New York; and finally, and most important in the opinion of the secretary, it would be too great a risk to give the building of such an important vessel to a new and inexperienced firm.

These considerations, taken with the further fact that Cramp & Sons consented to reduce their bid $55,000, or to that of the Bath Iron Works, has secured them the contract. To judge from the reasons given, we should say that the Cramps were entitled to the contract for the simple reason that the Bath Iron Works were not able to fill it according to the terms of the law, though we still insist that the proper time to ascertain whether or not a concern is fitted for such work is before bids are received from them, and that bids received from concerns undoubtedly and admittedly unable to carry out the contracts if awarded to them, should have no weight, and be given no consideration whatever.

We think that if the Bath Iron Works were prepared to give satisfactory bonds for the filling of the contract, according to the terms of the bidding and of the law, they should have received the contract, but if they could not do this then the contract belonged of right to the next higher bidder who could do this, and that he should not be required nor expected to reduce his bid a single dollar on account of the lower bid of a concern unable to fill the contract. Either the Bath Iron Works were entitled to the contract or they were not. If they were they should have had it, if not, the next higher bidder otherwise qualified should have had it, and at the figures of his bid if within the appropriation.

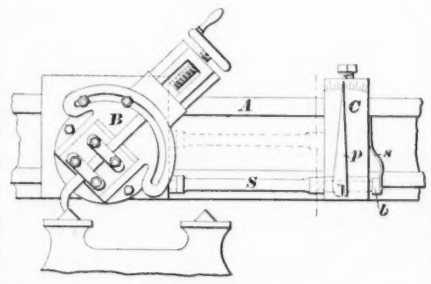
A Planing Device.

Mr. Joseph W. Nist, of Allegheny, Pa., writes that, having seen some reference in this paper to a gauge for obtaining accuracy in distance between the shears of lathes, slides of planers, etc., he concludes there may be readers of the AMERICAN MACHINIST who would be interested in his patented device intended to secure greater accuracy than is otherwise obtainable, especially on large planers.

This device we illustrate by the accompanying engraving, in which *A* is part of the cross-rail of a planer, *B* the head and *C*, a block which fits over the rail, can be placed in any position on it, and clamped by setscrews to any gib.

Passing through the lower part of this block *C* is a bolt *b* which slides freely through the block for a short distance, and is normally kept in its extreme position towards the left by the action of the spring *s*.

The standard bars *S* are placed between the other end of this bolt *b*, and the planer-head, sockets being provided for their reception. On the outer face of block *C* is pivoted



a pointer, the upper end of which passes over a scale, as shown, a pin inserted in bolt *b* engaging in a slot in this pointer, and thus causing it to indicate any movement of the bolt. By so adjusting the head for each cut that the pointer is brought to a predetermined graduation on the scale, exact movements of the head are obtained corresponding precisely to the length of the various standard bars used.

Mr. Nist also proposes to make the scale on the bar itself, when preferred, by making it in two parts, one to slide within the other, with a pointer on one of them passing through a slot in the other, a spring tending always to keep the bar extended to its fullest length.

Women as Car Conductors.

Women as conductors! That means a revolution in street-car etiquette.

"We do not propose to man our cars with lady conductors simply to create a sensation," said James L. Dyer, of 230 La Salle street. Mr. Dyer is the designer of the new Columbian coach, which it is promised will soon be a familiar feature of Chicago.

"Lady conductors are a necessity to us owing to the city ordinances," he continued. "There is an ordinance to the effect that no vehicles can be run on the boulevards unless there be a lady aboard. I suppose the object of the ordinance was to keep the boulevards for pleasure riding, and to secure this a gentleman is supposed to be out with a lady.

"But the ordinance is clearly nonsensical. For instance, I can ride down Michigan boulevard on a load of hay if I have a lady with me, but I can't make the same trip alone in a grocer's delivery wagon.

"During the World's Fair it will be absolutely necessary to utilize the boulevards for passenger traffic, and we purpose to evade an unjust ordinance by carrying our 'lady passengers' in the shape of conductors."

"Will you have the handsomest women you can find for your conductors?"

"We won't have any homely ones if we can help it," said Mr. Dyer. "There is no reason in the world why a woman should not engage in the legitimate occupation of street-car conductor. There are women lawyers, women doctors, women clergymen; women are gaining an entrance to the ranks of toilers everywhere. Why not in the street car? Our cars will be fitted up in palatial style, fit for the occupancy of any lady, and we shall maintain them as such."

"Don't you apprehend criticism of your idea?"

"Of course; but we will see that our women conductors maintain their proper decorum, and turn in all the nickels in due form."—*Chicago Tribune.*

A good many young mechanics, apprentices and engineers, we hope, propose to take advantage of the winter evening schools that will begin to open in a month or two. Now is the time to make plans for attending these courses. They are, in the main, conducted by accomplished engineers who are more than willing to put all the knowledge they have gained by years of experience and study at the service of their pupils. No such opportunities ever existed before as exist to-day in this respect. There is no reason in the world why a young man should not get all the technical education he desires, if he only puts the necessary energy into the operation.

For those who are financially able, the excellent technical schools afford a remarkable opportunity; for those who cannot, the evening schools in most of the large cities in the country provide a good substitute. For those who cannot avail themselves of either of these opportunities there remains the home study, with such assistance as will always be freely given. On the whole, there is to-day no excuse for ignorance on the part of any one who has nerve enough to push ahead. The main trouble is in the instance of young men who think that some one can *teach* them something without any particular effort on their part. That is a thing that never has and never will be accomplished. If a man ever in this world knows anything to speak about it will be only by a strong effort on his part.

It is being found that it is not practicable to secure and hold good firemen in the navy. The trouble appears to be that they are looked upon, aboard ship, as necessary evils, and are not allowed many privileges, because their occupation does not tend to cleanliness. So they are, when off duty, confined to narrow limits, which they very naturally object to.

Electricity is the title of a new paper to be published weekly by the Electricity Newspaper Company, Chicago, Ill. The first number is bright in appearance, and the publishers promise to keep it up to the mark in electrical matters. We wish it success.

We have received a copy of the proceedings of the American Boiler Manufacturers Association for 1891. It is an account of the meeting held at St. Louis, and is very complete and well edited.

In the year 1890 the South produced 1,953,459 net tons out of the total of 10,307,029 net tons of pig-iron produced in the United States, or, roughly, 19 per cent. of all.

According to the most reliable accounts, the prospects for good fall crops are excellent. This means a lively moving about of money and good business generally.

It is reported that M. Eiffel has invented a steel bridge for use in war. It is in parts, and can be put up in a hurry.

Can Kill at 200 Feet.

Augustus J. Bowie, of San Francisco, the author of a standard book on hydraulic mining, estimates that the stream from a six-inch nozzle, under 450 feet vertical pressure, delivers a blow of 588,735 foot-pounds every second, equivalent to 1,070 horse-power. "It is absolutely impossible," says Mr. Bowie, "to cut such a stream with an axe, or to make an impression on it with any other implement." Mr. Bowie adds that although never, to his knowledge, has a man been struck by such a stream as it comes from the pipe, several accidents have occurred where miners were killed by very much smaller streams at distances of 150 or 200 feet from the nozzle.—*The Eureka.*

If we can believe—as we expect we can—our English contemporaries, there is little comparative cause, in this country, to complain of slow railroad freight service. From eleven to thirty-four days is given as the time required to get freight a distance of twenty miles on one English road.

It is said that an oil well has recently been drilled in Hancock County, Ohio, that will yield 40,000 barrels per day. It is worked to only a small part of its capacity.

The American Society for the Advancement of Science meets this year in Washington, D. C., Aug. 18 to 25. Important work is mapped out for this meeting.

Reports for the last year, in relation to the railway mail service, show that only one instance occurs, in every 4,193 cases, of convict distribution.

According to a recent decision, in the instance of tin plate mills, skilled labor can be imported in all cases where an industry is not firmly established.

In Irwin, Pa., they recently celebrated in good style the first working of a plate glass works. A plate 128"x210" was successfully cast.

A land slide on the Skenna River, in British Columbia, recently swept away nine houses, and killed forty-one persons.

In Russia the government is being petitioned from several provinces for relief, the trouble being poor trade.

Brazil has 2,775 miles of railroads.

Greece has but one woolen mill.

Machinists' Supplies and Iron.

NEW YORK, August 8, 1891.

Iron—American Pig—The market is on an easier basis, and new business is at lower figures.

We quote: No. 1 Foundry, Standard Northern brands, $16.50 to $17; No. 2 is selling at $15 to $15.50, and Gray Forge at $13.90 to $15. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; and $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote at $23 for Coltness; $22 for Dalmellington; and $20.50 for Eglington.

Copper—The price for Lake Copper has dropped to 12c, and that figure influenced considerable business. Arizona Ingot is quoted at 12c. to 12¼c. Casting Copper is scarce at 12¼c. to 12⅝c., according to holder.

Lead—The market is very quiet and nominal. The Pig Lead market is firmer at 4.55c. to 4.65c., according to quantity and delivery.

Spelter—The market is stagnant, and business is solicited at 5c., for either spot or future delivery. It is claimed that the best brands are obtainable at that figure.

Tin—No business has been done for the past few days. Prices are nominal at 20.10c.

Antimony—The local market is easy.

We quote 11c. for Hallett's; 12⅝c. to 13c. for Cookson's, and 12c. for L. X.

Lard Oil—The market is unchanged at 53c. for Prime City, according to holder and quantity. Western on spot is quoted at 51c. to 52c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

An expd. eng. & mech draftsman is open for permanent engagement. Experience, AM. MACH.

A1 die sinker wants steady employment. Address Lock Box 1211, Pullman, Ill.

Wanted—Situation as foreman blacksmith; 10 years' experience as such; best references. Address BOX 82, AMERICAN MACHINIST.

Wanted—A foreman pattern maker with general experience. Address, giving references, Birmingham Iron Foundry, Birmingham, Conn.

Wanted—To correspond with machine firms in need of foreman or superintendent for their shops. Address P. L., AMERICAN MACHINIST.

Wanted—Mechanical engineer acquainted with engine business, as salesman; state age, experience, and salary required. W., AM. MACHINIST.

First-class tool and die maker having experience with contract work, wants sit.; West preferred; best refs. Address BOX 36, AMERICAN MACHINIST.

Position as supt. or manager in a mfg. establishment, varied prac. exp. in important positions; fully up in duplicate mfr. BOX 39, AM. MACHINIST.

Wanted—A position as foreman, boiler maker, or laying out work in a marine shop, by a practical man of long experience and thorough capability. Address Capable, AMERICAN MACHINIST.

Mech. engineer and draftsman, 30, good education, varied exp., desires permanent position, preferably in new enterprise; over seven years with present employers; good refs. BOX 37, AM. MACH.

Business opening for ingenious machinist who is away up in the best work, and the capabilities of all iron-working machines. Address Jno. Smith, care of Letter Carrier 23, Buffalo, N. Y.

An experienced machinist and tool maker, at present holding position as foreman, desires to make a change about Sept. 1st; South preferred. Address BOX 33, AMERICAN MACHINIST.

Wanted—For a good, permanent position, a first-class general machinist and tool maker. Address, stating age and experience, F. A. Hunter, No. 129 Fourth street, Detroit, Mich.

Draftsman, technical graduate, 6 years' exp. as machinist and tool maker, 7 as draftsman and designer of general, special and hydraulic machinery, seeks permanent engagement in N. Y. City or vicinity from Sept.; references. BOX 30, AM. MACHINIST.

Wanted—A foreman for machine shop manufacturing small vertical and horizontal engines; must be competent to produce duplicate work at a minimum cost. Give age, experience, and where occupying a similar position. Buffalo Forge Co., Buffalo, N. Y.

Machinist who is accustomed to high grade automatic engine work, simple and compound, and the use of indicator, is an experienced outside erector, and fair draftsman, desires employment; satisfactory reasons. BOX 38, AM. MACHINIST.

Wanted—A practical man, thoroughly acquainted with engines, having lots of push, with good address, to sell a metallic steam packing (and apply it, too, when necessary). None who cannot earn $2,500 per year need apply. Send full details to Substantial, care AMERICAN MACHINIST.

Wanted—Position by thoroughly prac. mechanic as general foreman or asst. superintendent; well up in modern mach. shop practice, and thoroughly well up in all kinds of engine work, and pumping and hydraulic machinery; best of references; have held above position with first-class firms. Address Howard, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Drawing made for Corliss and Slide Valve Engines and Gen. Mach'y. A. W. Jacobi, 136 Liberty St., N. Y.

Wanted—Parties to mfr. my pat. glass tube cutter. Write for partic. to W. T. Levi, Charleston, W. Va.

Working drawings of machinery and plans of mills drawn. Address BOX 40, AMERICAN MACHINIST.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

Fine Automatic Machy. Punch, Die & Screw Mach. Work Specialities. Send sample for low estimates. Novelty Mach. Works, Orange, N. Y. P. O. Box 434.

For Sale Cheap or Exchange—Eleven right and left modern Patent Automatic Cut-off Engine Patterns & Drawings, from 10″ to 20″. B 9, AM. MACH.

For Sale—Three 3-ton jib cranes, 20 feet height of mast, swing in space of 35 feet. Apply to The J. Morton Poole Company, Wilmington, Delaware.

Manufacturers wishing to change their location, or start anew, should write to M. L. Funkhouser, Carlisle, Pa., for inducements offered.

Wanted—Agents for Mechanics' Reference Book of Practical Rules and Tables. All mechanics should send 15 cents for this book. Address Summit Pub. Co., Akron, O., Box 40.

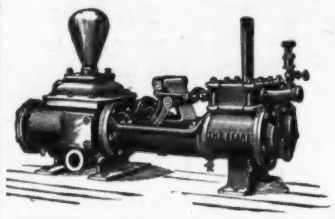
Machine shop and boiler shop, with all necessary tools, for sale or rent; located at West Point, Pa., twenty-four miles from Philadelphia. For particulars address D. C. Wismer, Quakertown, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

If Albert Potter, machinist, formerly of Topeka, Kan., and last heard from in Corpus Christie, Tex., will address immediately his old friend James P. Riordon, of Topeka, he will hear of something perhaps to his advantage.

For Sale—The Saline Iron Works, Warren, Ark. Has territory 40x60 miles that is tributary, comprising large tracts of pine and hard wood. A large number of saw, planing and grist-mills, gins, etc., already established. Owners desire to sell all of their interest, or to the right party a part interest, with control of the plant. A great bargain will be given in either case. If not sold by the 1st of Sept. wish to engage a first-class machinist as foreman.

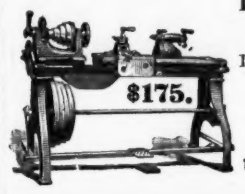
VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO'S
Pittsburgh, Pa.
Chicago, Ills.
New York, N. Y.

TOOL & DIE STEEL
of Uniform Quality and Great Strength.



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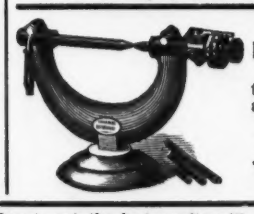

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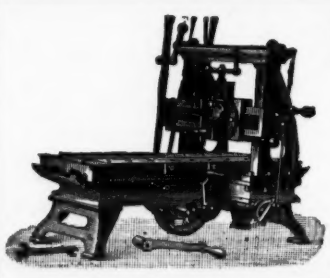

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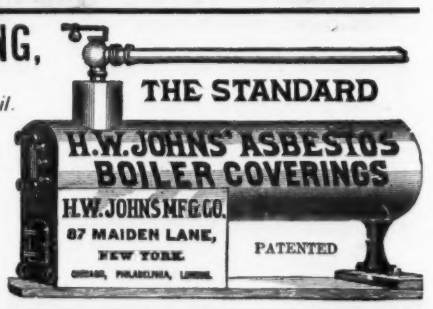

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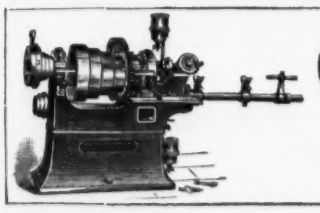

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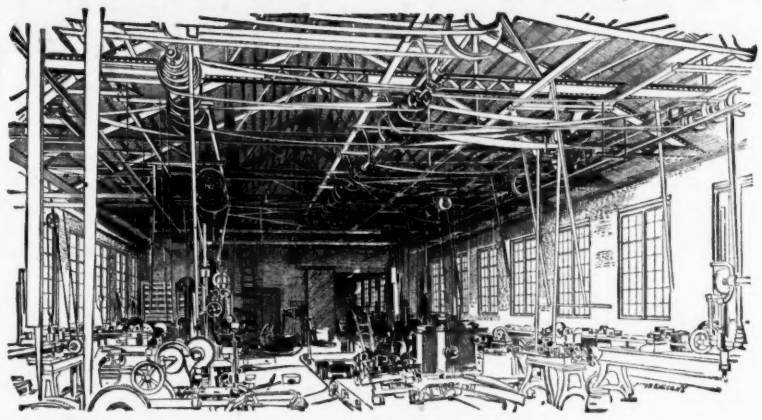

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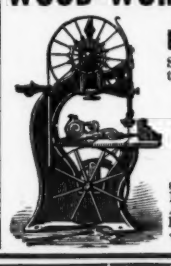

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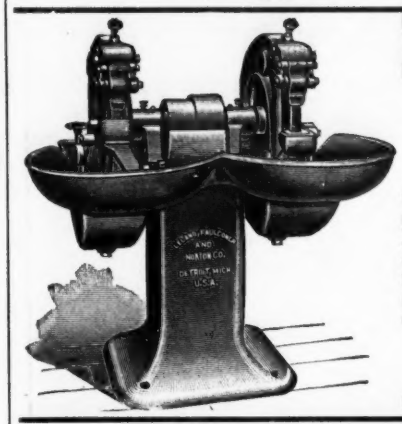

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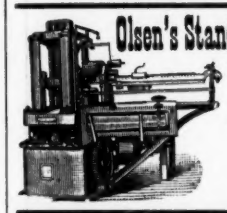

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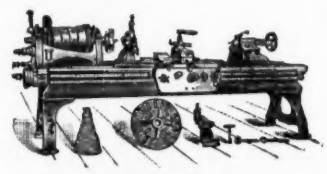

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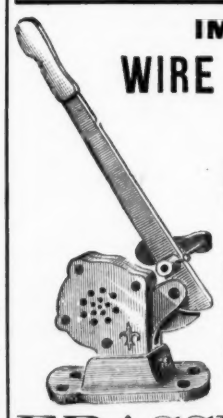

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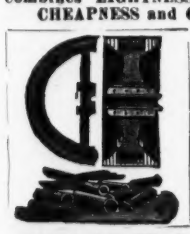

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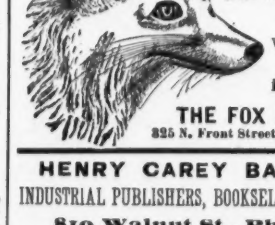

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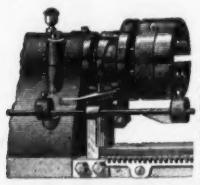

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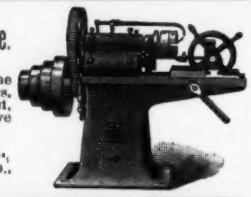

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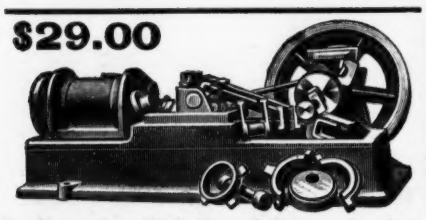

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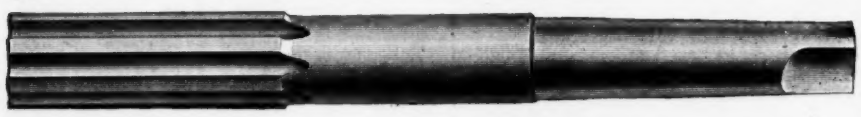

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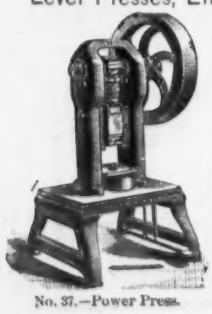

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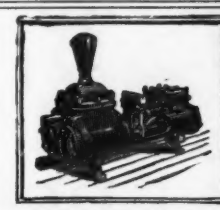

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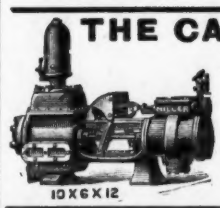

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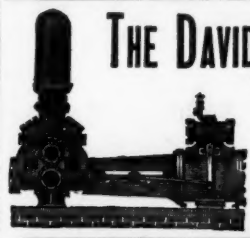

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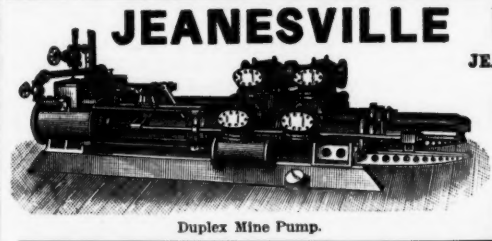

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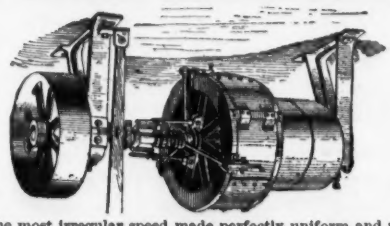

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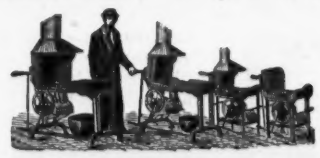

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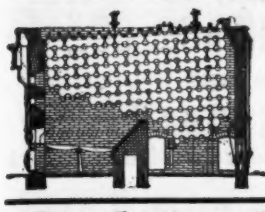

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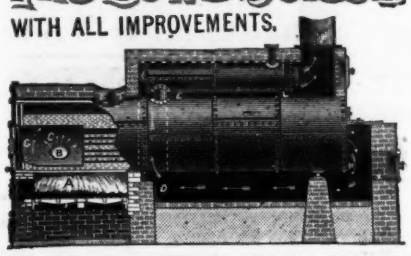

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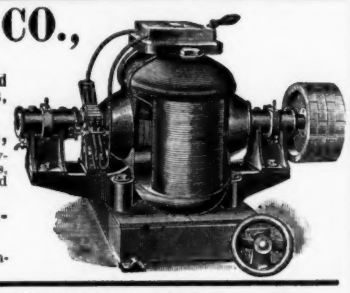

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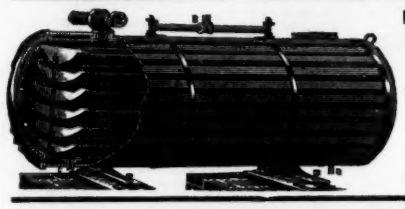

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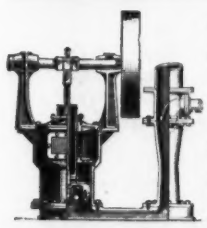

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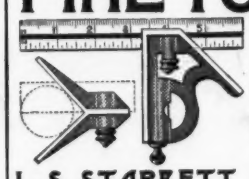

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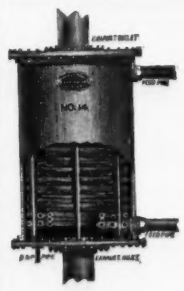

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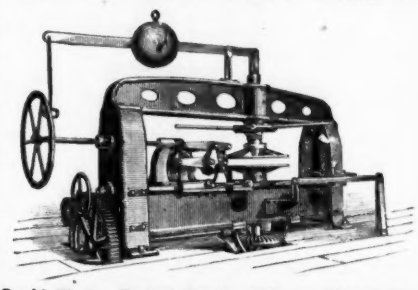

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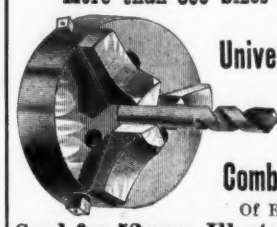

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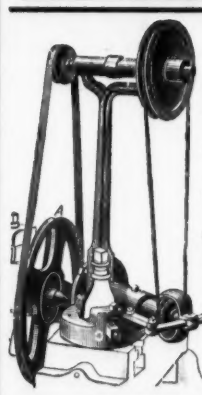

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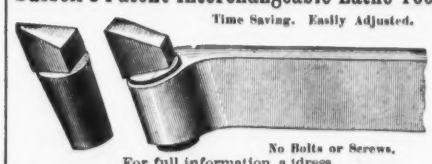

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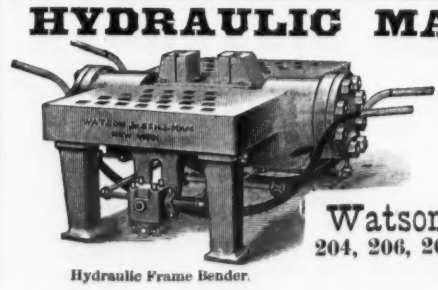

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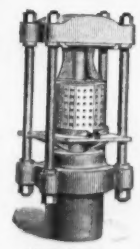

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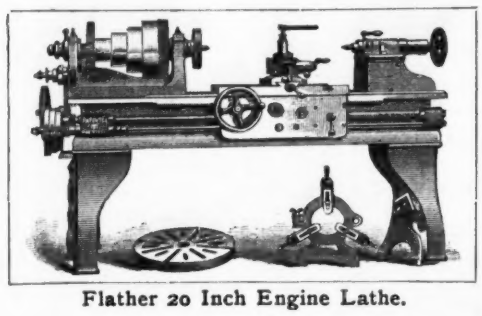

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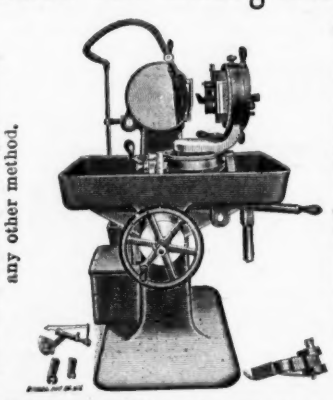

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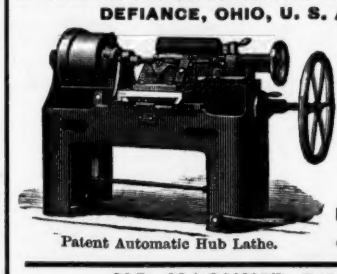

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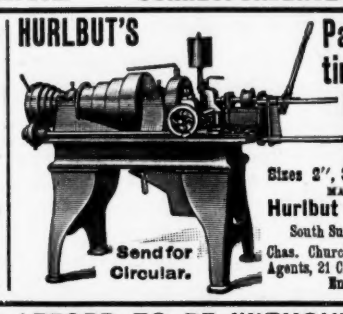

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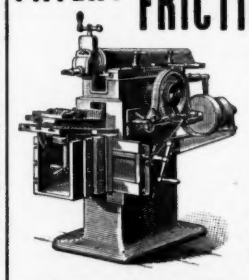

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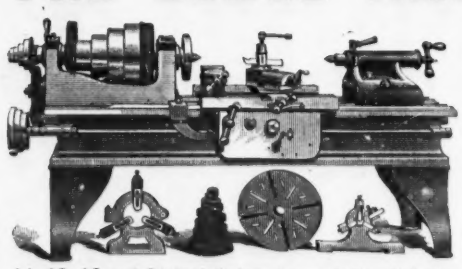

14, 16, 18 and 21-Inch Swing, Large Hollow Spindle.
Taper Attachment, Automatic Stop, Compound Rest, Lead Screw, under front V. All feeds reversed in apron.
Extra heavy, Convenient, and easily handled.

New York House, 64 Cortlandt St.
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24, 27, 30 and 38-Inch Swing, Cabinet Legs.

Pittsb'gh House, Mkt. & Water Sts.
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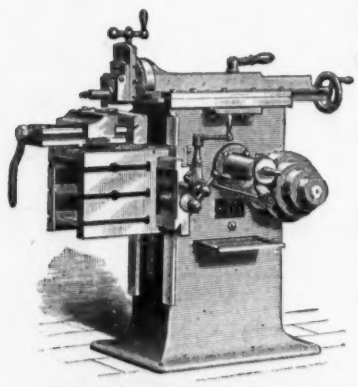
Sole Agent for Great Britain, ALFRED HERBERT, Coventry, England.

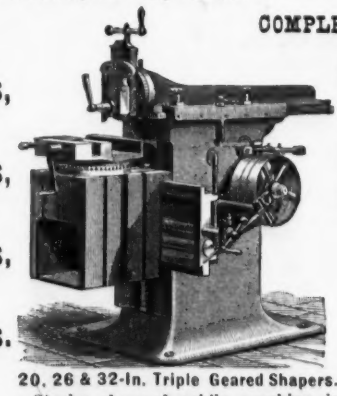
CABINET TURRETS, AUTO. MONITORS, FOX MONITORS, SPEED LATHES, &C.
COMPLETE BRASS WORKERS' OUTFITS.

COMPLETE MACHINE SHOP EQUIPMENTS A SPECIALTY.



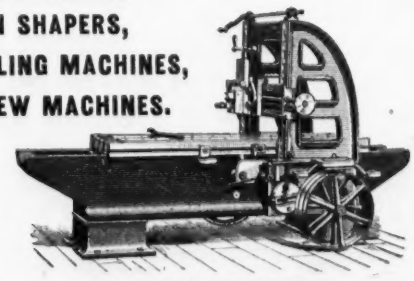
ENGINE LATHES,
TURRET LATHES,
PULLEY LATHES,
CHUCKING LATHES.

15 and 20-Inch Crank Shaper.
Stroke changed and adjusted while running. Stroke at all times positive.
Invariably plane to a line.
Detachable Tables.



20, 26 & 32-In. Triple Geared Shapers.
Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.
Special 26-In. Shaper with auto. down feed.

IRON PLANERS,
IRON SHAPERS,
MILLING MACHINES,
SCREW MACHINES.



24, 32 and 36-Inch Planers.
Extra deep beds and tables. Powerfully geared. Plenty of Metal and designed for extra heavy duty. All Feeds and Shipper operated from both sides.
Improved device for holding Planer Bolts.

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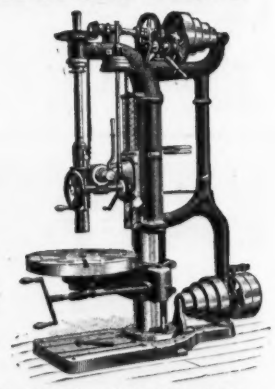
DRILL PRESSES,
BOILER MAKERS' DRILLS,
POST DRILLS.



25, 28, 32 and 40-Inch Drills.
Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

See Advertisement on Page 20.

MORSE TWIST DRILL AND MACHINE COMPANY,

Manufacturers of Morse Patent Straight-Lip Increase Twist Drills. New Bedford, MASS.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

ENGINE LATHES from 10 to 30 inches swing.
Also Hand Lathes, Foot Lathes and Milling Machines.

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14, 15, 16, 18, 20, 24 and 28 INCH SWING.
ANY LENGTH OF BED DESIRED.

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General Selling Agents,
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Price $8
NO GAUGES.
NO BELT.
Every Machine Guaranteed.

BARKER'S IMPROVED CENTER GRINDING MACHINE.
Manufactured by
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SEND FOR CIRCULAR.

☞ IMMEDIATE DELIVERY.
15" and 18" Crank } SHAPERS.
20" and 26" Geared }
JNO. STEPTOE & CO., Cincinnati, Ohio.

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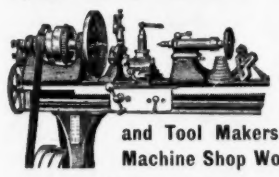

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High grade tools; elegant in design, superior in construction. The best foot power lathes made, and quality considered the cheapest. Send for catalogue and prices.

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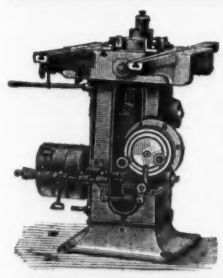

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Portable and Stationary.
Back-Cutting Attachment
Key-Making Machines.
Giant Key-Seater Co.
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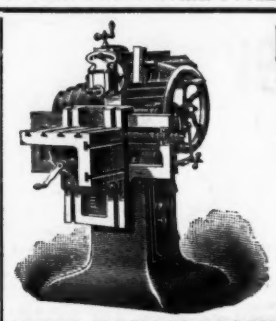
April 25, 1891. We are very much pleased with it, and think it the best machine on market for simplicity and effective work. DAVIS & COWGILL IRON WORKS, Omaha, Neb.



Lathes, Planers, Drills, Slotters, Etc.

NEW HAVEN MANUFAC'G CO.,
New Haven, Conn.

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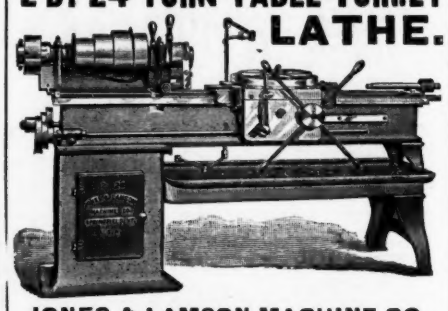
2 BY 24 TURN TABLE TURRET LATHE.



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L. W. POND MACHINE CO.

Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
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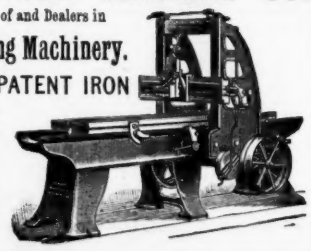

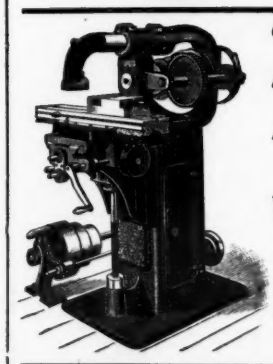

Complete Universal Milling Machines.
Plain Back Geared Milling Machines.
Plain Universal Heads.

All designed to meet the requirements of the best practice.

KEMPSMITH Machine Tool Co.,
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MANUFACTURERS OF

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D. SAUNDERS' SONS,

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MANUFACTURERS OF

Steam & Gas Fitters' Hand Tools.
Pipe Cutting, THREADING, AND Tapping Machines.
SEND FOR CIRCULAR.

THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe cutter made.

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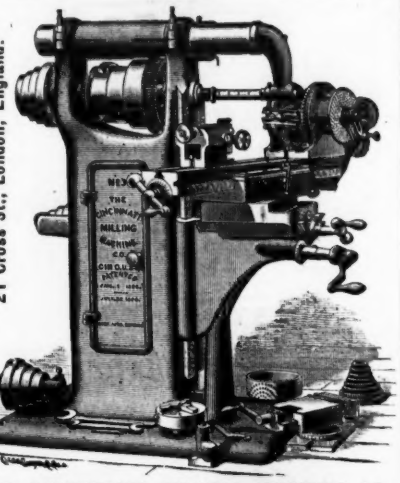

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Lathes from 10 in. to 20in. swing. Largest Variety of Drills manufactured in the world.
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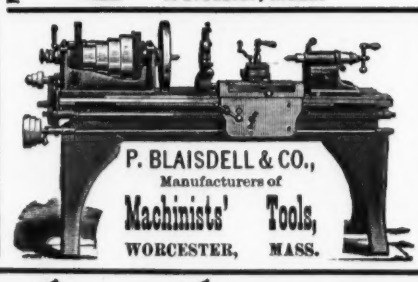

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Machinists' Tools,
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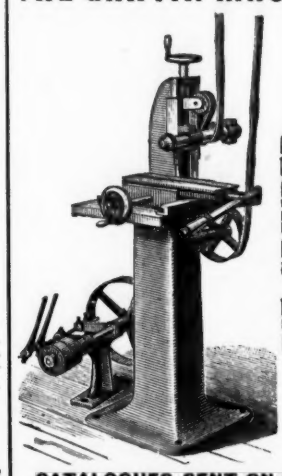
THE GARVIN MACHINE CO.



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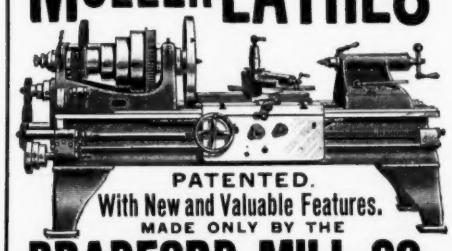

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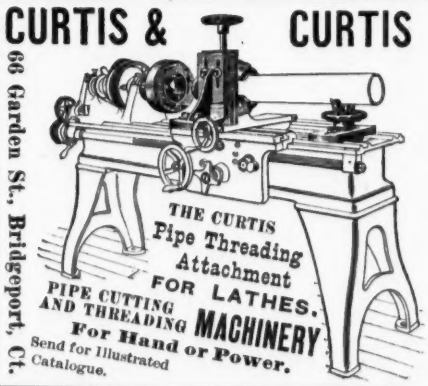
Bolt Cutting Machines.

CHAS. CHURCHILL & CO., Ltd, Agents, 21 Cross St., Finsbury, London, England.

CURTIS & CURTIS

66 Garden St., Bridgeport, Ct.



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PIPE CUTTING AND THREADING MACHINERY
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EVERY SIZE & STYLE.

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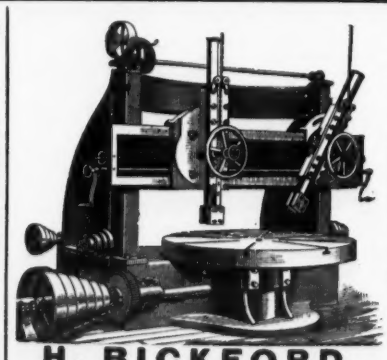

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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple Belt and Steam-Driven
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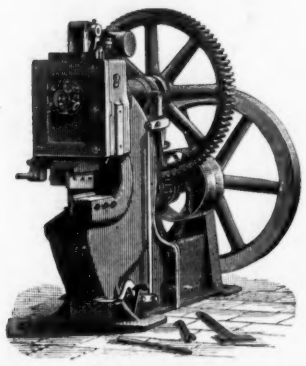
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POWER CUSHIONED HAMMER.
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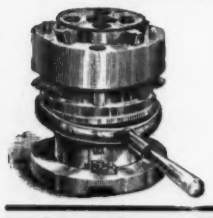
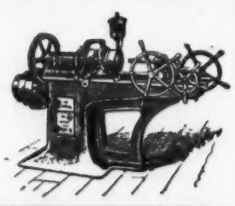
Complete outfits for Bolt shops.



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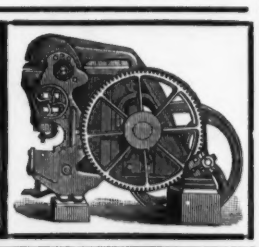

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One Set of 3 does the work of 12 common dogs.
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METAL-WORKING MACHINE TOOLS
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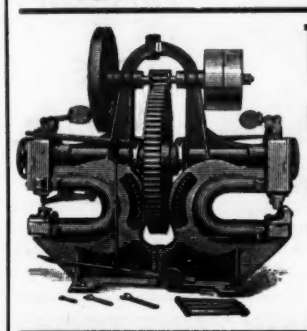
Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.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All Designs and Sizes,
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FOR
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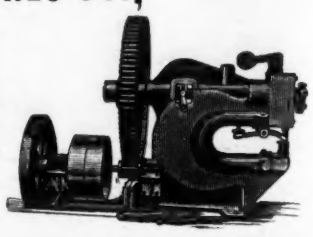

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ACME MACHINERY CO.
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Manufacturers of
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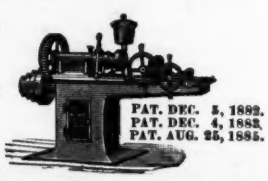
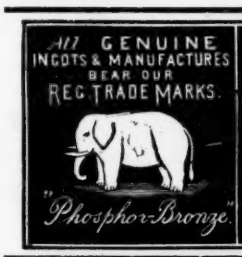
Acme Single & Double Automatic BOLT CUTTERS.
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.




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INGOTS, CASTINGS & MANUFACTURES.
THE PHOSPHOR BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

Freight Elevators,
Steam and hydraulic, completely equipped; or iron work only.
THE LANE & BODLEY CO.,
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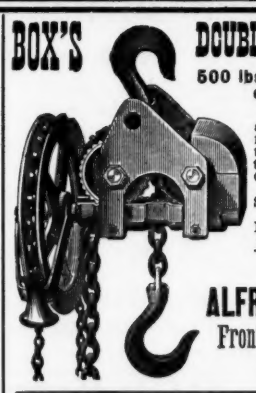
BOX'S DOUBLE SCREW HOIST,
500 lbs. to 20 Tons Capacity carried in Stock.

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Radial Drills for Machine Shop use.
Special Radials for Bridge Builders.
Photos and Cuts on Application.
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GENERAL AND EXPERIMENTAL MACHINE WORK. BEST FACILITIES IN CHICAGO.
NATIONAL MACHINE WORKS. 35 S° CANAL ST. CHICAGO ILL.

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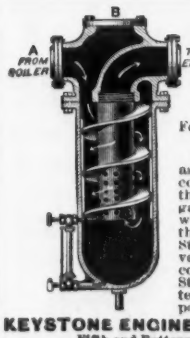
was **NOT** included in the test recently made at Cornell University. A claim is made in another Journal that Separator **B** showed the greatest efficiency due to corrugations of interior surfaces. We not having shown our Separator in the above mentioned test, it might lead the general public to imagine we do not possess the best Separator, which we claim we do, and can show greater efficiency than any Separator on the market, in a competitive test where all Separators are represented.
I respectfully request interested parties to investigate this theory to substantiate this claim.
JOSEPH DE RYCKE,
145 Broadway and 86 Liberty St.,
NEW YORK.



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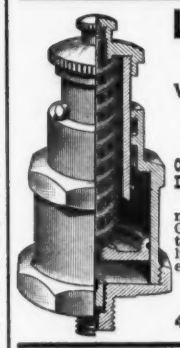
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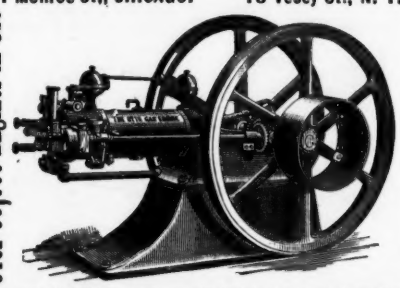

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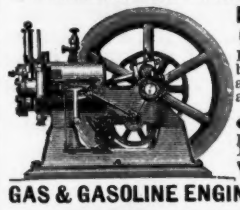

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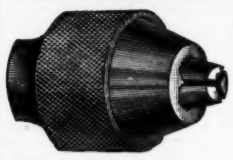

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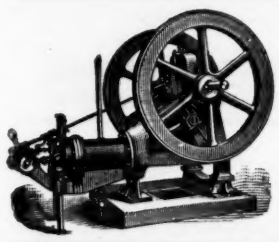

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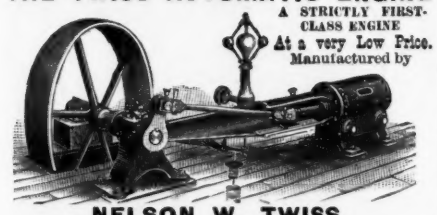

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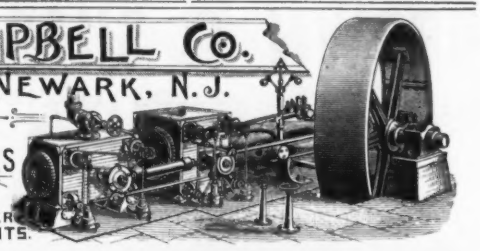

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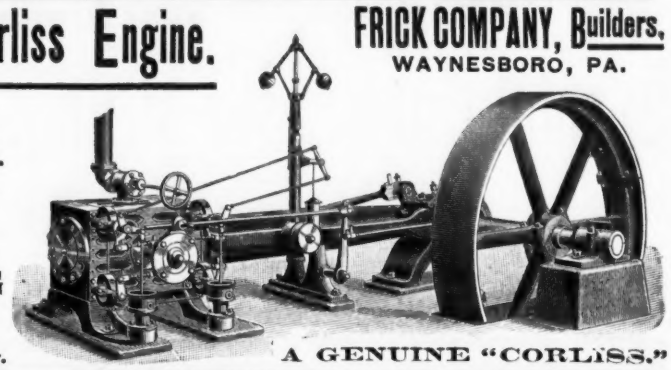

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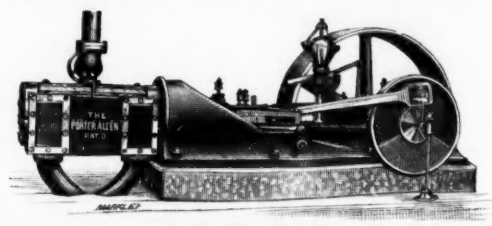

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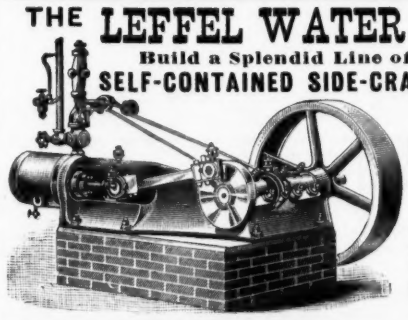

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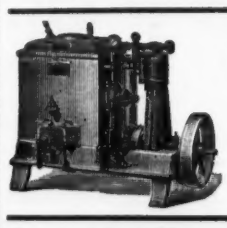

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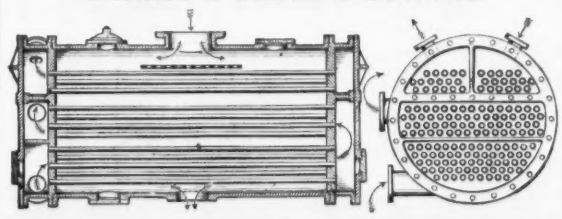

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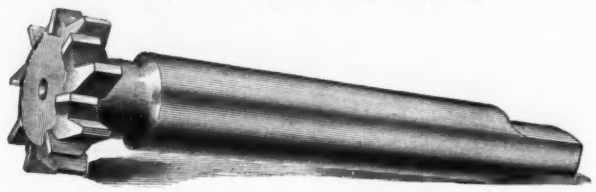

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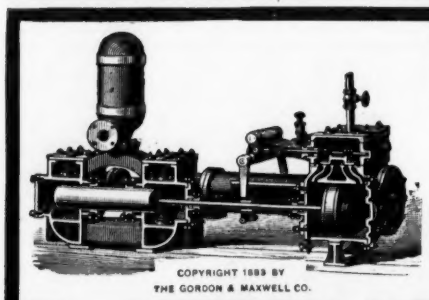

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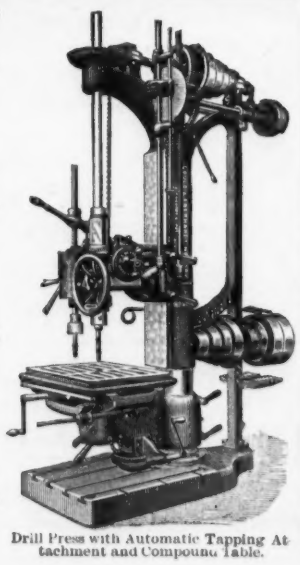

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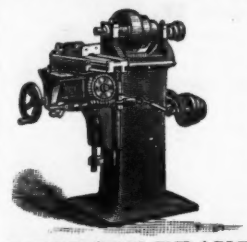

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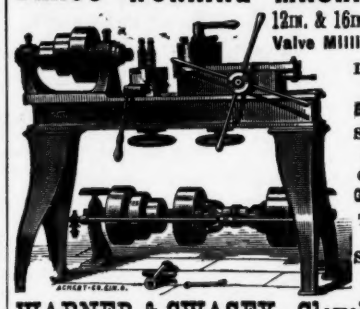

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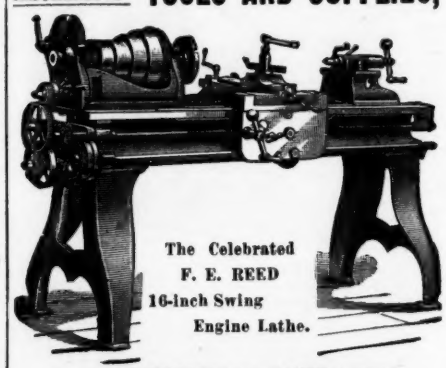

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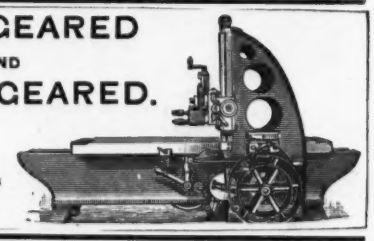

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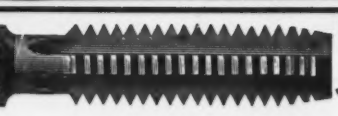

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